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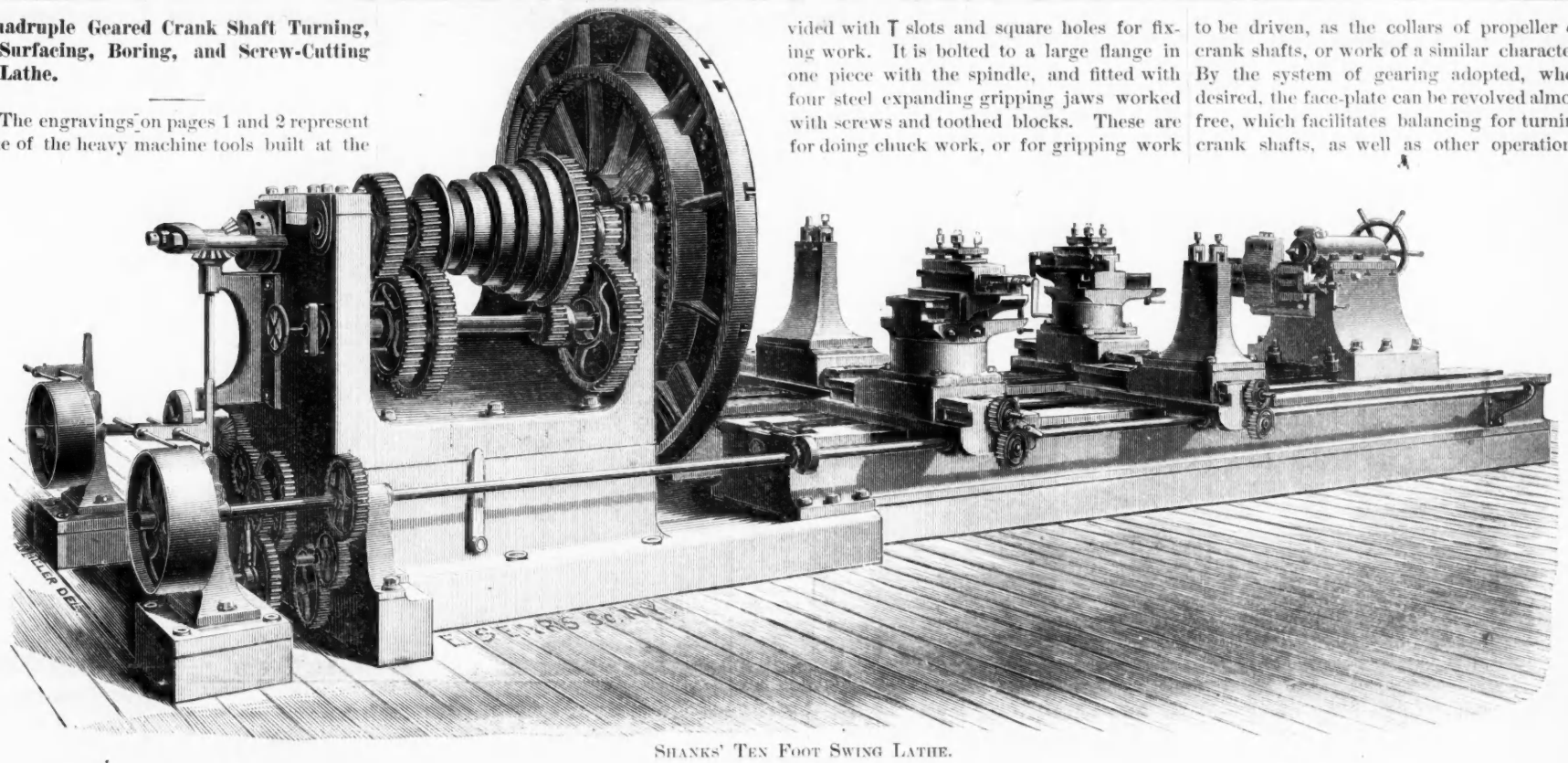
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Quadruple Geared Crank Shaft Turning, Surfacing, Boring, and Screw-Cutting Lathe.

The engravings on pages 1 and 2 represent one of the heavy machine tools built at the works of Thomas Shanks & Co., Johnstone, near Glasgow, Scotland. In addition to the perspective engraving, the engraving *A* represents a section through, and a partial plan of, the headstock; *B*, a cross-section through one of the front compound slide rests and a back pillow rest, and *C* and *D* views from opposite ends of the lathe. *E* represents a front elevation, and *F* a general plan. In these the lathe is represented as turning the crank-shaft of the Cunard steamship *Servia*, the shaft being shown in dotted lines.

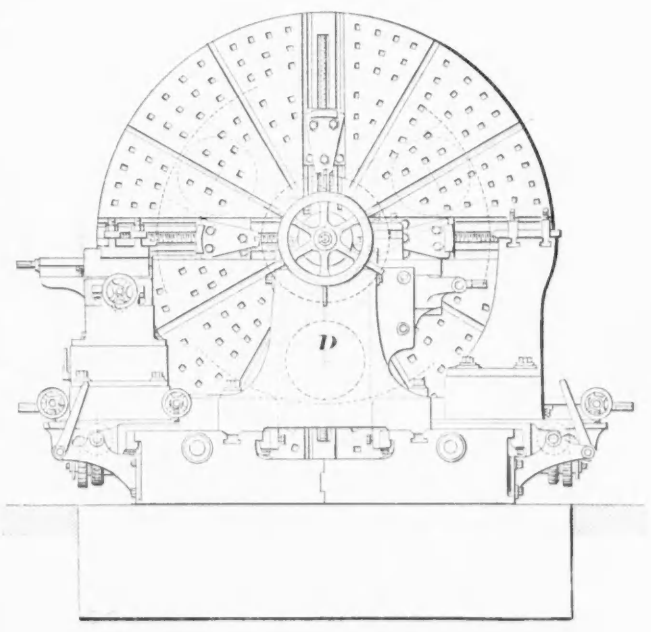


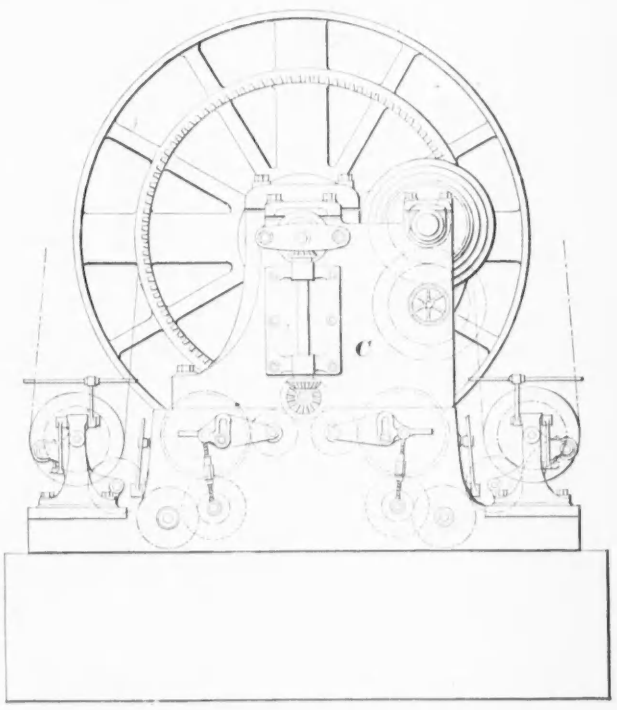
SHANKS' TEN FOOT SWING LATHE.

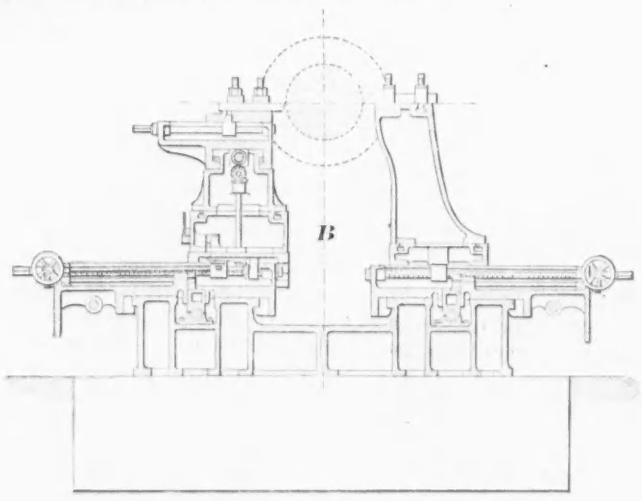
The centers of this lathe are 60 inches above the bed, and will admit a length of 30 feet between them.

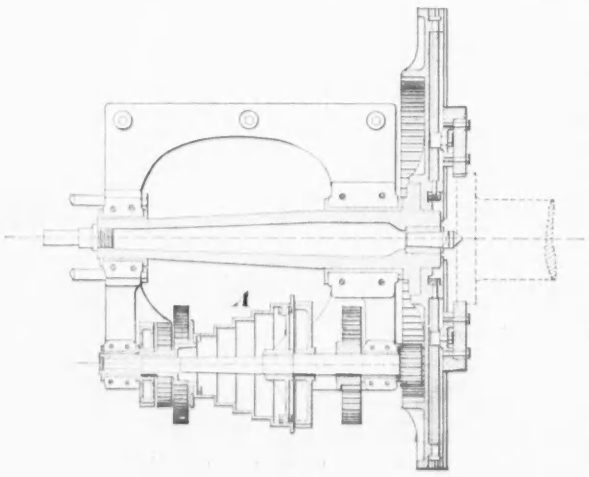
The headstock spindle has a front bearing 18 inches diameter and 24 inches long, and a back bearing 12 inches diameter and 15 inches long, the bearings being parallel. The driving cone has five changes of speed for a 6 inch belt, and is carried on an independent spindle. The cone is turned inside as well as outside, so as to be in balance at high speeds.

The face-plate is 12 feet diameter, cast with internal gear at the back. It is provided with T slots and square holes for fixing work. It is bolted to a large flange in one piece with the spindle, and fitted with four steel expanding gripping jaws worked with screws and toothed blocks. These are for doing chuck work, or for gripping work to be driven, as the collars of propeller or crank shafts, or work of a similar character. By the system of gearing adopted, when desired, the face-plate can be revolved almost free, which facilitates balancing for turning crank shafts, as well as other operations.



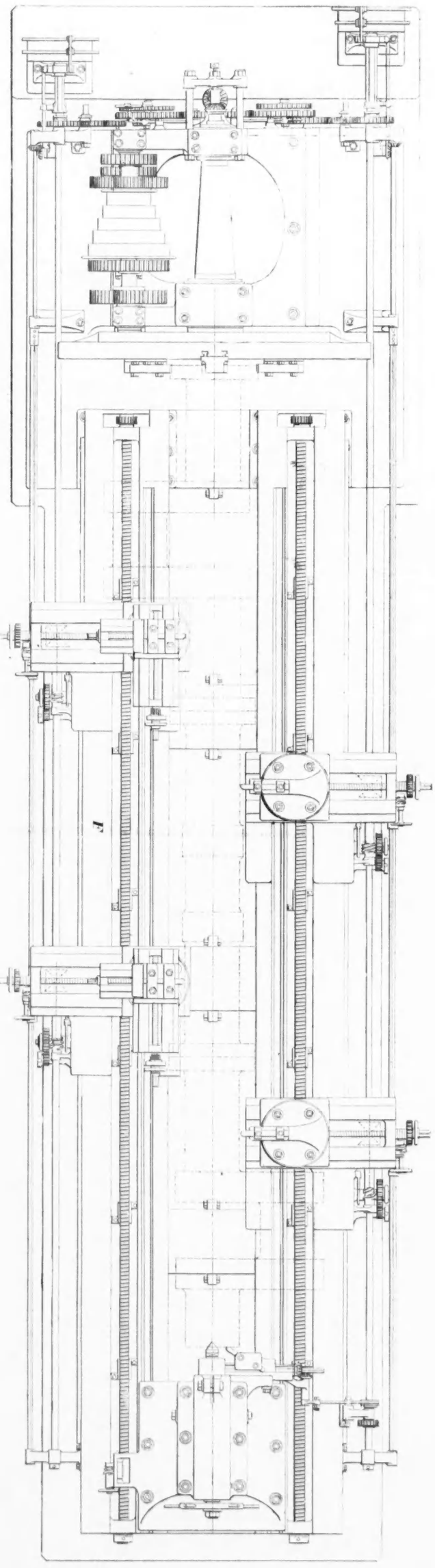


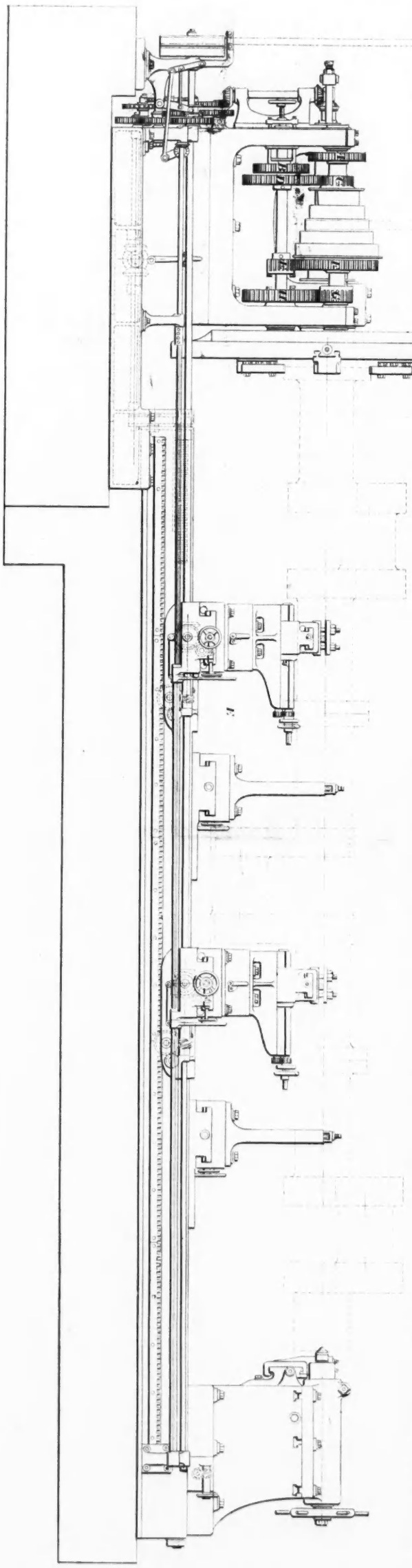




The thrust against the live spindle is taken by an adjustable steel tail piece.

The beds are double, 10 feet in width over all, the sections being joined together by massive ground-plates and bolts. They are made with square lips to resist the upward strain of cutting. The front bed is fitted with two saddles, each carrying a compound slide rest having the following movements: First, screw-cutting, by means of a leading screw, situated inside the bed, with a sliding disengaging nut and reversing motion for right or left hand threads, or for instantaneously stopping the longitudinal movement of the saddle. This is accomplished by a set of clutch mitres placed inside the bed at head-stock end, and actuated by a lever in front: Second, a self-acting sur-





facing motion to slide rest by means of a longitudinal shaft at the front of the bed, and clutch mitres for reversing the saddle screw.

Third—Power motion for moving the saddles quickly to position along the bed. This is done through the fast and loose pulleys at the headstock end of lathe.

Fourth—Hand rack motion to saddle. The back bed is fitted with two saddles, each carrying a pillar rest, fitted for all movements in plain turning like the front rests, and also with swiveling motion for corner turning.

The tailstock has a spindle 9 inches diameter. It is fitted in V's on the bed, and held down by three T head bolts on each side. The top section is adjustable for turning tapers. It is moved along the ways by engaging a nut with the main screw. An end-cutting rest is fitted to the tailstock, which is adapted for operating on flanged couplings and similar work.

There is a separate set of change wheels for each saddle, so arranged as to cut standard pitches up to 3 inch pitch, and for self-acting feeds down to 50 per inch. By this means, when both tools are in operation on a piece of work, one tool may be used with coarse feed for roughing out, while the other may be taking a fine or finishing cut either on the same or a different part of the piece: or one tool may be cutting towards and the other from the face plate, always maintaining the balance of a front and back cut.

Complete counter driving motion, consisting of wall brackets, shaft, cone, and sets of fast and loose pulleys for quick reversing motion in screw cutting, also belt bar shipping motion, and full set of case-hardened wrenches are provided.

The following table gives the reductions by gearing from face plate pinion alone, and from double, treble and quadruple gear; also the variations in speed for the five changes on cone, the letters referring to those on gears in engravings *A* and *E*:

A and *B*; *I* and *J* in gear reduces 9—Revolutions: 5.50; 8.30; 11.10; 16.16; 22.20.

C and *D*; *I* and *J* in gear reduces 22—Revolutions: 2.27; 3.40; 4.50; 6.80; 7.00.

A and *B*; *E* and *F*; *G* and *H*; *I* and *J* in gear reduces 76—Revolutions: 0.65; 0.97; 1.30; 1.98; 2.63.

C and *D*; *E* and *F*; *G* and *H*, *I* and *J* in gear reduces 187—Revolutions: 0.26; 0.40; 0.53; 0.85; 1.07.

Apprentice School Connected with the Brooks Locomotive Works.

In answer to a letter inquiring about the progress of the above school, we have received the following interesting reply:

DUNKIRK, N. Y., Oct. 20, 1883.

Your letter asking for information in regard to the apprentice school connected with the Brooks Locomotive Works has been referred to me, as having charge of the school, and I take pleasure in giving you information concerning it. The school was opened in January, 1883, to extend to the apprentices instruction in a practical direction, without expense to them for either tuition or books.

In return for this, it was expected that those receiving these advantages would appreciate them, and unite their efforts to make of this a grand success. Such expectations, if we may judge from the present fine condition of the school and the individual advancement being made by the pupils, bid fair to be realized by the founder of the school.

The school-room itself, furnishing as it does as pleasant a place as one could well imagine, has a tendency to make the boys feel that they can find there a pleasant place to spend the evening. There they have access to such valuable and practical reading matter as "Forney's Catechism of the Locomotive," "D. K. Clark on Railway Locomotives," "Appleton's Cyclopædia of Applied Mechanics," "Haswell's Pocket Book:" also Molesworth's "Ewbank's Hydraulics and Mechanics," "Shock on Steam Boilers," "Holley on European and American Railway Practice," "Rankine's Steam Engine," "Porter's Book on the Richards Indicator," McCord's Lessons in Mechanical Drawing; also "Minifie's Text Book of Mechanical Drawing," and other valuable and more elementary works of reference. They also have bound files of the *Railroad Gazette* and *Railway Age*. Besides these there are always on our tables current numbers of such papers as the AMERICAN MACHINIST, *Railroad Gazette*, *Railway Review*, *National Car Builder*, *Railway Age*, &c., &c., forming as you can see a technical library which would meet the demands of the most exacting. Here the apprentices can come, and, outside of the two hours spent in direct application to such studies as they are individually pursuing, they can have access to such standard works as above referred to, with the advantage of explanations and illustrations from two instructors, who have charge of the school.

The boys in the beginning of the instructions were so unevenly qualified that it was deemed best to instruct them individually, thereby becoming more thoroughly acquainted with the personal characteristics of each and giving such encouragement and directions as would best advance their interests and develop the desired qualities of ambition and perseverance.

Now that such a course has been pursued until the desired aims have been accomplished, it is contemplated forming classes of different grades, so that the boys in our school as well as other schools, may have an opportunity of doing that which is so necessary to bring out what is in a boy, that is, measure himself with his fellows, and get a taste of what he will be compelled to do when he is thrown upon his own resources.

In order to encourage the boys in their strivings for knowledge, Mr. Brooks has most generously offered the following prizes to be contended for:

"The following premiums will be given to those pupils showing the greatest improvement in their studies, and for the most punctual attendance for the year ending April 2d, 1884. The competition for the money premiums does not include the study of draughting:

1st. Premium..	$100.	2d. Premium..	$75.
3d. "	50.	4th. "	25.
5th. "	15.	6th. "	10.

For the greatest improvement in draughting one premium will be given, which will be a situation in our draughting department. Punctuality in attendance will have an important bearing on the distribution of premiums. Signed, H. G. BROOKS."

You can imagine that this document nicely engrossed and framed, hanging in the school-room, acts as a potent agent in encouraging a class of apprentices.

The boys are examined as to their qualifications and allowed to begin in their studies at what, in the opinion of the instructor, will be the most advantageous starting point.

Once having started them, after pointing out the advantages which an education will afford them, it has been found that the apprentices fully appreciate these advantages and enter into the spirit of the school with a determination to learn, and a persistency of application which would do credit to the majority of university students.

Aside from the prizes offered, the most deserving members of the school, to the number of thirty-two, were sent under the charge of the two instructors to the Exposition of Railway Appliances, at Chicago, free of expense to themselves.

Attendance upon the school is left to the choice of such apprentices as were connected with the works before the school was opened, but is obligatory upon all entering as apprentices since that time.

At present the class meets three nights in the week at seven o'clock P. M.

Those wishing to read or discuss topics in connection with their reading, meet in the school-room before that time or remain after the hour of regular school duties. As far as possible, the connection between the theoretical knowledge gained in the school-room and its practical application to the machines and processes of the workshop are pointed out as occasions call them out.

As you can see by the list of prizes offered, the study of mechanical drawing forms a very important branch of the instruction. In this branch the learners are started in the instrumental construction of plane figures and geometrical relations, along with the proper manipulation of the instruments, and from this stage are taught all the points necessary to the development of a "full fledged" draughtsman. Already we have some drawings which in finish and arrangement of details speak well for the advancement of one of our apprentices from the "rank and file," or I had better say from the "chisel and file," to that much-to-be-desired position in the finely equipped draughting department of these works.

PIERCE BUTLER.

The actual power required to operate an unbalanced slide valve, under various pressures and at different speeds, has never been even approximately determined.

The Milling Machine—Its Construction and Uses.

NINTH PAPER.

BY JOHN J. GRANT.

The subject of face milling is one that admits of more than a passing notice, and should have more attention paid to it than it has had up to the present time. The heavy cuts over large surfaces, that properly constructed machines are capable of accomplishing, and the almost endless variety of uses that such machines can be put to, should induce the manufacturers of heavy machinery of all descriptions to look more thoroughly into this matter. Milling machines of this class can be constructed in such a manner that the head of the machine, or the platen, or both, can be traversed. Such a machine, made so that the work is level with the floor, would be invaluable in locomotive or stationary engine shops, as well as in all classes of marine work. A machine of this description, if good judgment were used in designing, could be made on the universal plan; that is, made to perform more than one operation, and yet not be in any manner a complicated machine.

If heavy horizontal boring mills were made with the platen or cross slide very rigid and securely gibbed, having a substantial cross feed, they could be used for face milling to good advantage; and in a great many cases save the expense of resetting the work or removing it from the boring mill to the planer. Tools of this class must necessarily be very substantially built, with metal enough to absorb the vibration of the cutting tools, in

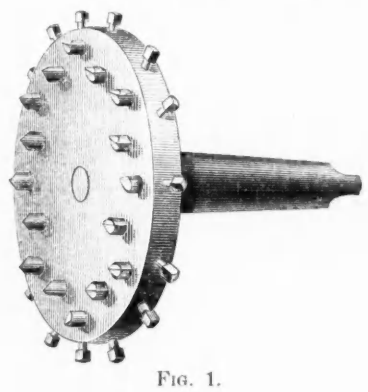


FIG. 1.

fact should be made on the "anvil principle." If the builder of machine tools could convince the buyers of the same that a few dollars extra paid for more cast iron put in the right place, was a savings bank to them from the time the tools were set up in the shop, there would be less tools of the chattering class in the shops of to-day. That you cannot do so, the writer has found to his loss.

The engraving, Fig. 1, shows a face mill or cutter suitable for any use that a tool of this description can be put to. Constructed as shown in the drawing, it will take a roughing and finishing chip at one operation. A cutter of this style can be made of any diameter from 4" upwards, as large as the work requires—20 ft. if necessary. Above 6" diameter, it may be made of cast iron—that is the center or body—and, where practicable, should be screwed directly to the spindle of the machine to get rid of the spring that is unavoidable in a shank or arbor. If the machine is made special and for large work, the driving power should be connected directly to the periphery of the cutter itself, as for instance, in a machine for facing the ends of bridge girders, columns and other similar work. The cutter is made as follows: A centre of suitable size for the work required, made of either cast iron or steel, is threaded for the spindle or arbor, and should be turned and faced perfectly true. This is necessary, as will be seen further on. Supposing the cutter to be 12" diameter, it should be about 2½" thick, and have 16 tools or cutters. The number of cutters may, of course, be more or less, but 16 will be found right. The tools are inserted in the following manner: two circles are scribed on the face, one of 10" and one of 9" diameter. Each circle is divided into eight equal parts, the divisions of the inner circle being between the ones in the outer circle.

For a cutter of this size, holes ½" diameter 1½" deep are drilled at each division. The holes are then drilled through and tapped $\frac{5}{16}$" standard to receive set screws for the purpose of adjusting the tools forward as they are ground away. On the periphery, and in a line with the holes for the tools, are set screws ⅜" diameter, for holding the tools in place.

The tools are made preferably of Stubbs steel rods, because it is cheaper than to center and turn short pieces.

The tools in the outer circle should project from the face about ½", and in the inner circle just enough farther to take a finishing chip, say about $\frac{1}{64}$". They are flattened the whole length to receive the set screw *B*. The outside of the tools are backed off enough for clearance, and the front to radial lines with the center. The face is cleared only enough to cut. The tool is shown full size in Fig. 2.

A gauge, Fig. 3, made double ended, is used to set the tools by, one end being for the tools in the inner and one for those in the outer circle. The operation of this cutter is as follows: the tools in the outer circle being in advance of the inner ones come in contact with the work first, and remove the scale. As soon as the work moves far enough to strike the inner row of tools, they being farther out from the face of the cutter, remove the balance of the stock. The necessity for having the body of the cutter perfectly true is now seen, as the tools are adjusted by the face, and if it were not perfectly true only part of them would cut.

A properly constructed cutter grinder

Fig. 2. Cutting Tool.

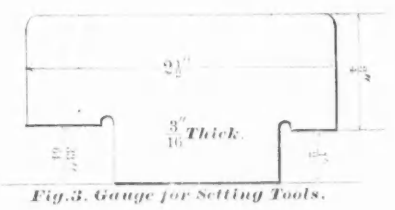


Fig. 3. Gauge for Setting Tools.

would grind cutters of this class until they required redressing. The amount of work a cutter made in the above manner will do without renewing the tools is surprising; and when worn out, the expense of renewing them is only slight in comparison with renewing cutters made from solid steel, or made with dovetailed cutters. Any one having work that can be done by this process, and that is doing it with a planer, is losing money, and I would suggest to such that he look about for machines of this description, and adopt them to his profit.

Some of our large machine shops in the Eastern States are not so far ahead with the best appliances for doing work as they might be. In a large railroad repair shop we were lately shown a flexible drill shaft as something new. The party using the shaft was highly pleased with its performance, and appeared to think it was an ingenious novelty. Shafts of that kind were in use in the Centennial Exhibition buildings, and we have seen them in Colorado and New Mexico shops four years ago, but they do not seem to have become so well known in the East as they deserve to be.

New Locomotive Works.

The erection of the new shops, belonging to the recently-formed McQueen Locomotive Works Company, is being pushed forward vigorously at Schenectady, N. Y. The works will occupy a plot of ground conveniently located, to the west of the Jones Car Works, between the New York Central and the Delaware and Hudson Canal Company's railroad tracks. The machine shop—a building 300x122 feet—is ready for the roof, and the foundation of a boiler and blacksmith shop, 400x72 feet, has been laid, and the walls are up about four feet. Ample room has been secured for extending the works as more buildings are needed. All the buildings will be one story, that plan being preferred on account of its admitting of better lighting than higher buildings. They expect to get the machinery into the buildings during the winter, so that the works will be ready for operation in spring. The most improved tools will be selected for the works, and the best methods of getting out work will be adopted.

The company starts with a capital of $300,000. The officers are ex-Senator Charles Stanford, president; William McCann, treasurer. The executive committee consists of Walter McQueen, Walter Jones, and John McIneroe. H. Watkeys is superintendent, and he is looking after the erection of the works.

New York Central Shops at West Albany.

The New York Central and Hudson River Railroad shops at West Albany have 17 locomotives in the repair shop getting overhauled. This company is doing very heavy repairs to many of the old engines which came into their possession by the purchase of roads in operation. In some cases the rebuilding amounts almost to renewal. In common with many other companies throughout the country, the New York Central Railroad finds it does not pay to work with antiquated tools, and they are selling a great deal of their old machinery, and replacing it with the most modern appliances. This road pursues the policy of working up old material into the forms from which the new appliances are constructed, so far as that can be done economically. They keep two huge steam hammers at work all the time, working up scrap into axles, frames, trucks, equalizers, rods and so on. All castings that can be got out without chills they make themselves, but they find it cheaper to buy chilled castings than to erect the plant needed for their production.

In looking round these shops, we observed a Buchanan fire-box just newly finished and ready to put inside the shell. There is a great deal of excellent work expended on these fire-boxes and they are put together in a remarkably strong way. These fire-boxes are doing well, and their record as fuel savers continues so good that other roads would save money by adopting them. The shops are well arranged for handling work economically. Mr. Ortton, the master mechanic, believes in thoroughness in all the work done.

Weak Objections to Street Locomotives.

A committee which made a report on motive power to the First Annual Convention of the American Street Railway Association, which met in Chicago lately, made some curious statements about traction. They object to all forms of locomotives, owing to the inability to secure sufficient friction to propel crowded cars under difficulties. Speaking of this class of motors they say, "that they have an insurmountable barrier to overcome so long as they rely upon merely rotating the wheels to apply the power."

One would suppose, from reading the report of this committee, that they were not aware that railways are everywhere in successful operation with power applied by the rotating of the wheels. Every argument they produce against this method of applying power was used by the enemies of locomotives fifty years ago, and they succeeded in getting wire ropes tried, the pet scheme of the committee in question. Wire ropes will work, but the plan is expensive and troublesome. We would advise street railroad companies, anxious to improve their motive power, not to lose sight of the locomotive.

Mr. D. M. Swaim, a steamboat owner of the Upper Mississippi, has applied a compound engine to a new river steamer. The tandem-cylinder style of engine has been adopted, and this is reputed to be the first compound engine on Western rivers.

Setting and Centering Cores.

BY THOS. D. WEST.

If there is any one thing that a machinist dislikes it is boring out holes that are not cored centrally. And why a moulder cannot always set cores centrally is something of a conundrum to him. Moulders can sometimes make excuses, and are generally ready to take a cast iron oath that the core was set right, which the machinist, of course, cannot dispute. Still it will, I believe, be acknowledged by nearly all moulders that excuses for cores out of center are about the worst kind of excuses we have to make. When you get a moulder so that he cannot say anything, it is a sin to torment him further, but it is n't often that you will get him there.

Why it is that *all* cores cannot be set centrally, is something that cannot be fully explained. To set a core centrally or straight, does not call for any great mechanical skill. What is demanded is *care* and *thought*.

The accompanying engraving may assist in showing why some holes do *not* come central, and perhaps afford some help in setting cores.

The cause of holes being out of the center is not always on account of the cores not having been set centrally. There are many things, such as uneven closing of flasks, bad fitting flasks, ill fitting cores, &c., any of which may result in crooked holes. Some readers of the AMERICAN MACHINIST will remember about three years back of discussions upon core prints. To my mind the elaborate systems that some writers advocated had but little to do with what prints are practically used for. Prints are for no other purpose than giving bearings and holding cores.

And whether bottom core prints are tapering, as seen in *Third core*, or straight as shown in all the others, has but little to do with the holes being out of the center, which I think is a vital part of the question. The top prints are the essential ones, and even they often have but very little to do with poor holes. As a general thing long top taper prints afford a better chance for the cores to accommodate themselves to their center. For long cores where there is uncertainty about measuring, such prints as are shown with *First core* are reasonably certain of providing for a true hole. This form of a print is the most reliable one that can be used, as with it the moulder can see whether the core is in its right place or not. In fact, by the use of such a print, it would be a hard matter to get the core out of its center. Some may think such prints should always be used, but they are objectionable from the extra labor and time which their use involves. It may be said that there is no gain, if through the quicker plan the casting is lost; but all castings are not lost. It is only the ones that are wanted in a hurry that we lose.

The cause of many crooked holes where the popular common top-tapering print is used, is as illustrated at *Third core*. As a general thing nearly all pulleys, gear wheels, &c., have either feeders or pouring gates on the hub. These holes break away or weaken a portion of what should be a firm, true, sound, tapering print, and the core leans to the weak side with the result shown.

There are a few moulders who always close such moulds as the above, with the gates in place, as shown at *Second core*. By this plan it is evident that much of the risk is lessened.

The gaggering and nailing around the *Second core* is another safeguard against the core crowding the print to one side. Another point that will bear looking at is that of the taper ends of cores.

A large number of foundries make all their common sizes of round cores, without having the taper end formed. Then again, a large number of shops make their cores, having the taper end on them.

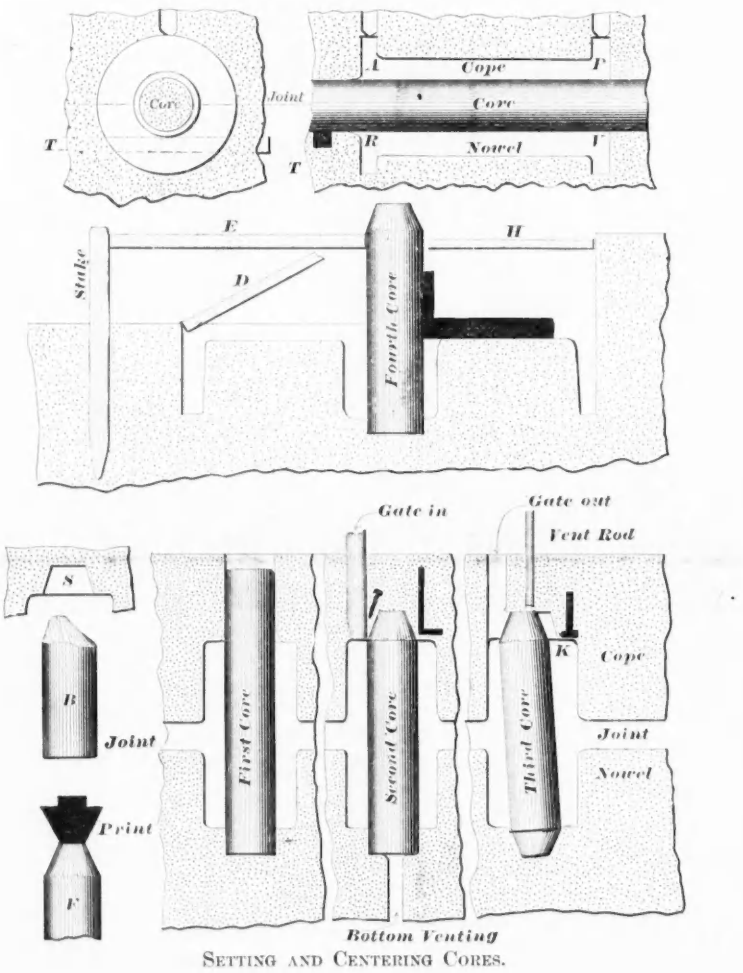
Filing a taper on cores is often very objectionable, especially when done by a careless moulder. A fair illustration of careless work of this kind is shown on core *B*. If a central hole is got with such a core it can't be charged to good management.

A careful moulder will compare his print and core together, as seen at *F*, thereby making a core that is likely to fit and fill the female print *S*.

Cores with taper prints are often one-sided from being laid down upon plates to dry, although some, by nailing the heads, or packing sand under to hold them up, will get a very fair tapered head.

In some shops, in order to get good round straight cores they are dried in half round iron boxes of the same diameter as the cores. This is the only reliable way of making true taper end round straight cores. The plan is an old one, and the cause of its unpopularity is the expense of making the cast iron boxes.

At *E*, *D*, *H*, and at the square, are shown the methods generally employed in setting and centering cores. With the exception of *E*, the plans are popular and call for no comment. *E* is a plan whereby cores in such moulds as green sand propeller wheels, and others having no points to measure from satisfactorily, can be centered. The plan is



SETTING AND CENTERING CORES.

simply the driving of three or four stakes outside or away from the mould, before the pattern is drawn, the stick, *E*, being placed against the pattern print, and all the stakes driven the length of the stick away from the print. The core, when set by the same stick, will of course occupy the same position in the mould as the print, and therefore as far as centering is concerned, must be right. The plan is applicable in other ways than shown: and while the idea may be old to some, it will be new to many.

The carrying off of such core vents through the cope is often the cause of weakening top prints, and also the cause of blow ups, from metal getting into the vent. To avoid this danger, it is the better plan to carry off the vent through the bottom board, or by running a long vent down into the moulding floor, as in the case of bedded-in molds.

Some will say, that is all right, providing you have a cinder bed under the mould. I have carried off the vent of cores as large as one foot in diameter, and more in length, by simply driving a $\frac{3}{8}$ in. vent rod down two or three feet in the sand below the mould. Green sand, where you have a large body, is capable of carrying off and holding more gas than is generally thought; and to such as have never tried this plan, I would say, do so: for I know they will find it a safe and reliable way of carrying off vertically set core vents.

In the upper part of the cut are represented ideas, that to the novice may be of some value. It represents the finning or chamfering of core prints, in order to prevent the crushing of flanges, &c.

There is much that might be said upon the question of horizontal core setting. But I will at present confine myself to saying a few words upon flange crushing, a thing very likely to occur. The greatest cause of flange crushing is probably due to the irregularity and over-size of cores. Should any of my moulders lose a casting through the above cause, I would hold them responsible, although I might reprimand the core-maker for making the core too large. In our shop it is the custom for all pipes or moulds having flanges upon them to be tried off and on. This gives the moulder a chance to see if there is any liability of his mould or flanges being crushed; and if there is, he has time to go for the core-maker, in which he will have my assistance. The practice of thus trying off and on all such moulds, has been the means of saving many a casting from going to the scrap pile. I think it is a safe assertion to make, that in not one of fifty shops (and I feel like doubling the number) is this the rule. I know that it takes more time; but will say that in our shop I have yet to see a casting lost through having a crushed flange; a thing that but few foundrymen can say.

Having all castings good, far more than balances, in dollars and cents, the little extra time taken up in trying off and on all such copes.

Fast Time With Heavy Trains.

Engine 415, lately built by the Schenectady Locomotive Works for the Michigan Central Railroad, on a recent trip, which was timed by the division master mechanic, took 13 cars, 7 of them being sleepers, and 1 dining car, from St. Thomas to Windsor, 111 miles, in 2 hours and 38 minutes running time. This was at the rate of 42.1 miles an hour, and speed had to be made up after several stops and slowing down. On another occasion the same engine took 7 cars, four of which were sleepers, from St. Thomas to Buffalo, and made a running time of 51 miles an hour. Considering that these runs were made through a country with numerous small towns that were traversed on the level with the streets, where some reduction of speed was necessary, the record made was something remarkable. The engine that did this work has cylinders 18″x24″ and drivers 70″ diameter. The weight in working order is 44 tons. The engine steams remarkably well, and there is no reason why she should not keep up a speed of 70 miles an hour if desirable. The weight of the train would have to be reduced, but we believe the engine could run at 70 miles an hour, keeping it up, and pull 4 sleepers or their equivalent.

The Glasgow *Engineer* concludes an article describing a monster pumping engine erected in Nevada, in the following complimentary style:

"So accustomed are we, now-a-days, to the gigantic erections contrived by American engineers and constructors, that almost any announcement as to monster engines, blast furnaces, or huge pumping appliances, is viewed as the natural outcome of devices planned and carried out in a regular go-ahead fashion, by an ingenious and calculative nation of artificers."

Making Nathan & Dreyfus Injectors.

Near the East River, at the foot of 106th Street, New York, stands an oblong three-story building with "Nathan & Dreyfus" painted in large letters on the end walls. Here the injectors, lubricators and other brass fittings handled by that firm are made. In the course of an inspection of the establishment we were impressed with its neat and orderly condition, and with the systematic arrangement of the work. Special tools are largely called into requisition in performing the various operations of the work. Division of labor has been utilized to its utmost limit, the workmen being continually employed on one recurring operation, and each becomes so agile at his particular job that work is turned out accurately with surprising rapidity.

To follow the injector in its course from the melting crucible to the finished article, we enter the foundry where we see the first operation of mixing the brass in the molten furnace. The foundry is a one-story building behind the main shop. There are fourteen furnaces kept at work to heat crucibles that hold a charge of 150 pounds each. The best gun metal is used for the shell of the injectors, and hard hydraulic metal for the inside tubes. The foundry is paved, and the floor is kept a model of cleanliness. When the injector casting is turned out of the mould and cooled, the sand is brushed off and it is taken to a small shearing machine, where the gates and fins are cut off. Further cleaning is done on an emery wheel which is located in the foundry, and then the casting is ready for testing. This is done by a machine in the boiler room, which closes up all apertures, and subjects the inside of the casting to a pressure of about 120 pounds to the square inch. This ordeal nearly always indicates the presence of defects should they exist.

From the testing machine the casting goes to the second floor, where most of the lathe work is done. This floor contains four rows of machines, mostly turret lathes, and every machine has certain operations to do in an endless cycle of work. A lathesman at the head of a row takes the injector casting, and chucks it lengthwise in an adjustable concentric chuck on a lathe whose turret contains six different tools, most of them specially designed for this work. While in the adjustable chuck all the holes in the side of the barrel are roughed, drilled, finished and tapped by the tools in the turret. By a similar series of operations the holes for the steam, water and overflow connections are reamed and the threads cut. In performing the different parts of the work care is taken to leave light cutting for the finely adjusted tools that do the finishing touches. Each opening is finished to an exact size which fits an accurate gauge, so that every part is interchangeable. The boring out of the barrel is done by a tool with cutters ad-

justed to make seven cuts of different diameters. By this means the complex barrel is bored out at one operation. Then the injector is sent ahead and the lathesman takes the next.

Meanwhile the fittings have been passing through the other machines. One man works on inside tubes continually; another turns out steam valves, while others labor on couplings, over-flow cocks, and so on, each keeping to his own department. Here, as in the case of the main casting, each part is made exact to gauge, and many of the operations are regulated by stops on the lathes. All the finished work moves towards one point—the fitting up department. There the principal work to be done is putting the pieces together. There is no fitting, as the expression is generally understood in machine shops, but merely the putting of each part in its own place, and screwing them properly together.

From the fitting up department, the injectors go back to the testing-room where they are subjected to a searching trial to work water under different pressures of steam. Having gone through this ordeal satisfactorily, they go to the finishing room where they are buffed and polished, the latter being the final operation of the workshop. They are then packed and made ready for shipment.

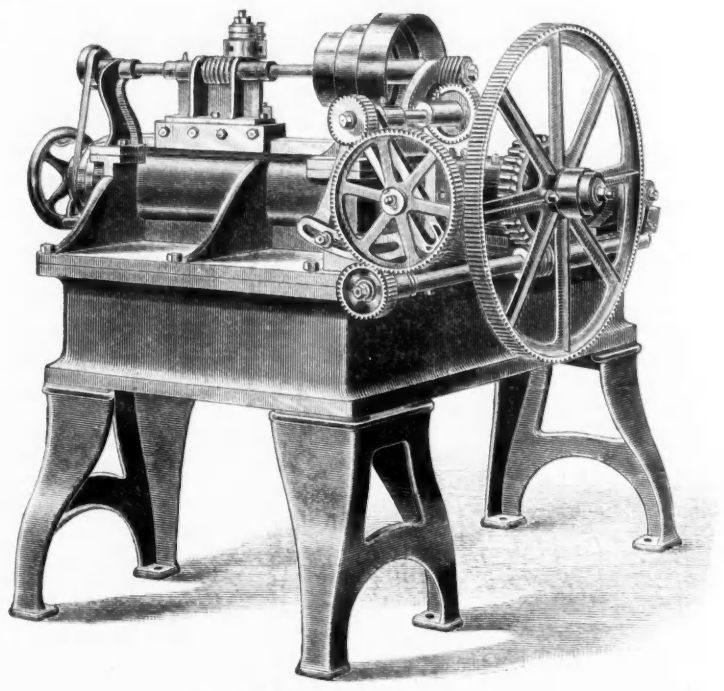
New Machine Tools.

The 19-inch engine lathe represented is one recently brought out by the Pratt & Whitney Company, Hartford, Conn. The carriage is gibbed the entire length on the outside, and is furnished with a tool-post by which the tool may be adjusted for height without being loosened in the post, and rigidly held at any angle.

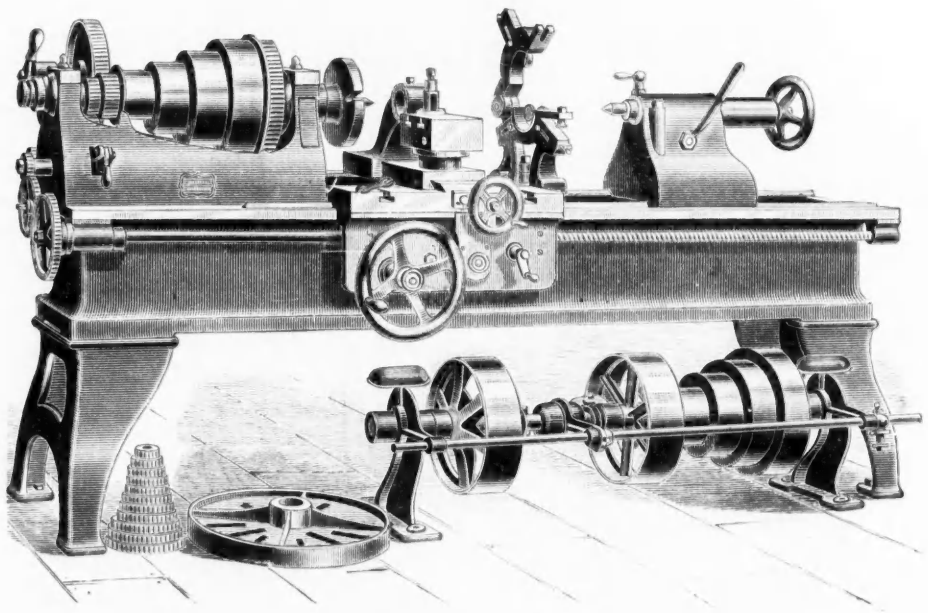
The line spindle is hollow, the hole being $1\frac{1}{16}$ inch diameter, which is the same as the diameter of the small end of the center. The front bearing is $3\frac{3}{8}$ inches diameter by $5\frac{1}{4}$ inches in length, and the screwed end $2\frac{3}{4}$ inches diameter, five threads to the inch. The largest diameter of the cone pulley is 14 inches, the width of belt being $3\frac{1}{4}$ inches. The carriage has automatic cross-feed, and the taper attachment may be used at any point in the length of the bed. For screw cutting, the usual gears furnished provide for cutting threads from two to thirty-two to the inch. Stationary and follow rests, large face plate, wrenches, and countershaft with 14 x 4-inch pulleys, are furnished with the lathe. When desired, a compound rest is furnished extra. This can be substituted for the elevating rest at any time in a few minutes.

The gear wheel-cutting machine represents a rear view of the same Company's 48-inch machine. These machines are made to cut both spur and worm wheels, or either only. When arranged for cutting spur wheels, the cutter arbor has vertical adjustment for centering the cutters, which are held at a convenient height for observing their working. The arbor is driven uniformly and strongly by means of bronze worm gear and steel worm and shaft, the latter driven by a $3\frac{1}{2}$-inch belt on a cone pulley. The nut by which the cutter is fastened extends down through a journal box, making a strong, substantial support for the lower end of the arbor, the bearing being protected from dirt by a close-fitting sleeve. The outer end of the horizontal screw for adjusting the carriage carries a plate, graduated in thousandths of an inch, for adjustment of depth to be cut. The main spindle is five inches diameter, with hole $2\frac{1}{2}$ inches for arbor. The dividing apparatus consists of a correctly-divided spur gear and pinion, their proportions being twenty to one, 64 ratchet disks, 6 inches diameter, for giving divisions of the circle up to 360°, and a pawl operating between two stops that are set to the number of teeth to give the required pitch. The large dividing wheel is released and clamped by hand lever at each movement of the pawl. The feed and stop motions are automatic.

The worm gear cutting attachment has positive motion, the ratio between the cutter arbor and blank being controlled by change gears, a hob of somewhat peculiar construction finishing the gear without the use of a blocking-out cutter.



48-INCH GEAR CUTTING MACHINE.



19-INCH ENGINE LATHE.

Extracts from Chordal's Letters.

MAKING DIFFICULT OPERATIONS SEEM EASY—CHORDAL FORGETS ONE OF HIS OWN SUGGESTIONS—TOOL ROOMS DON'T INVOLVE MICROMETER MEASUREMENTS—INSPIRATION OF THE WORD "INSTALLATION"—AN ORDERLY KIND OF DISORDER—WHAT THE TOOL ROOM SUGGESTS—HOW COWEN RUN HIS SHOP WITHOUT A TOOL ROOM AND HOW HE MADE A CHANGE.

Mr. Editor:

* * * You will probably notice, Mr. Editor, that in many of my letters I have suggested acts and modes of procedure without going into any details of operations, and I have often been accused of belittling the difficulties attending certain operations, or rather of speaking of things in such a matter-of-course way as to lead folks to think that some grand undertaking of a lifetime could be properly attempted on a Friday afternoon with the hope of finishing it before Sunday. I wish broadly to disclaim any real intention one way or another in these matters. The utmost good that I have ever hoped to do has been to suggest to the susceptible mind the mere expediency of a diligent inquiry into the expediency of a project.

A few days ago I was in a large concern, and there was unfolded to me a certain plan of doing things. The whole thing met with my admiration, and I asked different questions, and the head of the concern said in about three words "Chordal put me on to this thing." He did not know Chordal when he saw him, and I certainly did not know Chordal's suggestion when I saw it, but by digging back I found some trifling suggestion which had furnished the topic for thought for a real intelligent manager. I shall consider my office in this world well filled if I am successful in these letters in putting a few wide-awake, go-ahead men "on to" a few things which may develop, and make a success in their business.

* * * I have often spoken in these letters about tool room systems. I may have spoken admiringly of many of the complete tool rooms which I have seen; I may have ridiculed the concern which operated without a tool room, but I do not suppose that there is any one better aware than myself of the existence of vast numbers of shops in which not a single man has ever seen a tool room, or heard any intelligent description of a tool room. If such a man should get a description of a tool room, and especially of a complete and perfect one, it would be all the discouragement which he would need.

I went through a tool room in a certain shop, and if I should put on paper a memorandum of the elegant things which I saw, of the perfect and accurate system employed, of the rare ingenuity displayed in the construction and arrangement of tools, of the rigid accountability to which the men were held, and of the large sums of money expended in the maintenance of the feature, no man now without a tool room would ever think of starting late in life with this grand affair as a model in view. The picture of the perfect tool room would be a picture of the perfect hopelessness of the man without the tool room.

* * * I can put my own general idea of the value of a tool-room in a few words. To wit: That there is not a machine shop in the country so small, or so poor, or so mean, that it cannot afford the luxury. A tool-room is not an expense; it is an element of economy from the word go. It doesn't involve more labor; it saves labor. It doesn't take up room; it saves room.

* * * Most people in thinking of tool-rooms have their minds drawn at once toward measuring machines, and standard inches, and millionth parts of standard inches, and Verniers and micrometers, and expansion reamers, and all such as that. The real fact is that there is no real reasonable association between a tool-room and the extra fine measurements. That the employment of one may be an outgrowth of the other is true, but that an improvement in the accuracy of operations in a concern is to precede the inauguration or the installation of a tool-room, I most respectfully deny.

* * * If there is any word in the English language, which, no matter how appropriate it may be, is assuming a somewhat slangy aspect, it is this word "installation;" of European birth, of electrical importation, it has received a hearty electrical nourishment, and has repaid tenfold for the tender care bestowed upon it. I do not understand how many of our electric light companies could have hoped for a continued existence were it not for the heavenly influence of this magnificent word "installation."

* * * There is an old saying "a place for everything, and everything in its place." But it is not enough. The place must not only exist, but its place of existence must be known. The knowledge that there is a place for something, and that that something is in its place, is a precious small satisfaction to me if I do not know where to go to look for the place. The place should be in a manner self-indexing; otherwise we have an orderly kind of a disorder, which is the worst kind of a disorder known.

In my tramping days I struck a boarding house where one of the boarders, a boiler maker, used a barrel for a trunk. You can imagine what sort of a receptacle it was, and in what order the contents were. The owner of this elegant trunk, if twitted on the subject, fell back upon [this] old [saying. He said the place for [all] his [things was in that barrel, and all of his things were in that barrel, therefore was the saying fulfilled.

* * * The word tool-room suggests by its very sound a setting apart of valuable space for tools; it suggests the employing of a man in charge; it suggests an entirely new way of doing things; it suggests the stocking of a room with tools; it suggests no end of expenditure; it suggests a something which it would take years to inaugurate in an ordinary shop.

* * * If a great good involves too much trouble or expense we are apt to put off the enjoyment of it, while a small beginning in a good way may lead to, in the end, the perfect thing. It is my purpose to show that it is possible, in a machine shop, to start a tool-room in ten minutes, and without ten cents' expense. I propose that, while this is a mere start, it is the real thing after all; that the thing once started will be so satisfactory that it will never be stopped; that the full benefits of a tool-room will be felt from the start, and that no expenditures, on account of a tool-room, will become a burden not compensated for by the savings of a tool-room. I will illustrate the matter by giving the tool-room history of a certain shop, and hope I will not be asked to point out the location of the concern.

* * * Hugh Cowen was a Scotchman, with a shop working about seventy-five men on every imaginable kind of machine shop work. His shop was just like any other ordinary every-day shop; he had no tool-room, and did not know what a tool-room was; but I will describe his general tool arrangements. As to drills, there were lots of them around each

drilling machine—flat drills and twist drills, odd counter-bores, pin drills, and flue cutters, and all such things as that. No two drill presses would receive the same drill. There were square shank drills, and taper shank drills, and parallel shank drills. If a man wanted to drill a three-quarter's hole, he tried to find a three-quarter's drill; if he found one, all right; if he found one a trifle too big, he ground it down; if he found one a trifle too small, he used it, unless it was a great deal too small; if entirely too small, he took it to the blacksmith's shop and had it spread. If he wanted an extra long drill, he unhesitatingly had it blacksmithed out of some long inch drill, or something like that. When he got done with the drill he left it in the drill press. When the next man came he took it out of the drill press and threw it on the floor. Briefly, there was an unorganized and unsuitable and expensive lot of drills kept in stock upon the floor. As to taps, four or five visemen had, by some hocus-pocus, got possession of certain odd taps, and by the exercise of the usual generosity and meanness, and bulldozing and pilfering, there managed to be a fair interchange of the use of these taps. If a new tap was wanted, the foreman had one made by any lathesman who was thought capable of making a tap, and that lathesman would make a thing which might be a magnificent tap or it might not, depending largely upon the lathesman himself, upon the humor he was in, upon the lathe he worked at, upon the piece of steel he made it out of, and upon the length of time he had in which to make it. A nice five-eighths plug tap represented ten hours' labor, and stood a fair chance of being ruined at any stage between the cutting-off of the steel and the first twist it got in a hole. There was no regularity about the sizes of the taps, and in fitting work around the shop it was very important to know just exactly what tap had been used in the hole. Bolt cutter taps were made large, as is the common and pernicious custom. Some of the plug taps would be made as large as the bolt taps, and some of the bolt taps would be made as small as the plug taps. If a tap got broken, no provision was made for replacing it until the instant need occurred, and no new tap replaced an old one as long as the old one could be forced into a hole. As to reamers, there were but two in the shop. What they had been made for no one knew and no one cared. There were punching machines in the shop, and you could only count, with certainty, upon the existence of the punching tool actually in the machine. There were two or three friendless little drill-chucks kicking around the shop, and one or two of the men in the shop knew where to lay their hands on some little twist drills. The dogs were of the cur variety, full-blooded curs at that, and the breed running down. Boring bars were made occasionally to be used in a lathe or in a drilling machine. They went on the floor, and a few months' knocking around put them in bad shape. The mandrels consisted of a miscellaneous lot of chunks of bar iron piled around under the lathes, and most anywheres, in fact. A man wanting a mandrel took the job with him, and went on a general skirmish after something that would fit. If he found something to fit, he would use it if he could—and I will say right here that it is a pretty hard sort of a mandrel, pretty badly bent and a good deal too tight, or a good deal too loose, if a man can't make it go if he sets his mind on it. There were three or four ratchet-drilling arrangements around the shop in the usual bad order of public property, and if you wanted one of them the shortest process of getting it was to commence at one end of the shop, and keep your eyes open and ask questions and keep on until you found it. To find drills to fit it involved simply more questions and more skirmishing, or the simple act of getting a new one made—most always the latter. Bolt-cutter dies, together with the miscellaneous taps and dies in which no one claimed a proprietary personal interest, were kept in a certain drawer where about everything else was kept that could be said to have an actual place in the shop. While this drawer was the place for everything, there was no certainty of finding the thing there, and very often you would not even find the drawer there. It may have been carried off to the light; it may be turned upside down on the floor. The hack-saw could always be found without trouble; it hung on a certain nail, and it was very seldom that a man using it failed to hang it back. Inexplicable mystery attaching to the hack-saw! There used to be a brace in the shop—a regular carpenter's brace; nobody knows what has become of the brace; ditto a certain hand vise; ditto a pair of cutting plyers; ditto lots of things. Tools and material for repairing belts had a place in the foreman's little lockup desk.

* * * Hugh Cowen was not an old man to detect the weaknesses in his own concern. He made a tour of the country and visited all of the fine and systematic shops, and went into elegant tool-rooms, &c., knowing full well that they were not for him, and then he came back home and stuck a little notice up in the shop reading as follows: "I respectfully request that all taps in the shop be delivered to John Morris before noon to-morrow. They can be got from him whenever wanted, and must be returned to him. Comply with this request or expect a discharge. HUGH COWEN."

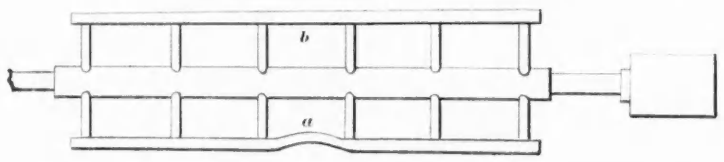
John Morris was one of the visemen in the shop—no more a tool maker than he was a pattern maker, but Hugh Cowen did not care for that. He went to him and said, "I have ordered all the taps in the shop brought to you, and I want you to take care of them."

* * * The next day the window-sill at John Morris's vise bench was piled full of taps, and it was simply astonishing to find how many taps, and what a variety of them, there was in this shop. In a week Hugh Cowen scratched out the word "taps" and inserted the word "drills" in the notice aforesaid, and he gave John Morris instructions, further, simply to take care of them. It looked a good deal cleaner on the floor around the drill presses, and in two days without anybody understanding why it should be so, it was found that if a man wanted a five-eighth drill for a certain drill-press John Morris had that drill. It was not only there, but it was a five-eighth drill, as close as the accuracy of the shop called for. If John Morris did not have the drill he would agree to have it in the course of twenty minutes, and he did have it. In the course of a week or two the ratchet drills were hung on pegs on the wall alongside John Morris's vise, and John Morris came into possession of all the tools to fit them. In some unaccountable way the sockets in all these ratchet affairs became uniform. I suppose John Morris must have chipped and filed them out so that they were all alike, which made the drills available all around. John Morris might have done this years ago, but it was not his business; but somehow or other he had made it his business now, and that without a suggestion. He was simply clothed with responsibility. Pretty soon the foreman orders an overhauling of the drill-press spindles, and they become all alike, and the sockets, and all such things as that, would fit anything in the shop. I wonder what made the foreman think of that, or rather why he did not think of it years before, five, ten, fifteen, twenty years before?

* * * It soon turned out that there was always a five-eighth tap in the possession of John Morris, and if a new one was needed, it was John Morris who reported it, and for some reason unknown this tap was at once made and always by the same lathesman, who became the expert in the matter of tap making. He devoted a little attention to the nice annealing of steel, and so on, and he got so he could make a fair sort of a tap in a reasonable length of time, and his five-eighths taps were all alike—that is they were "his" five-eighths, which might differ from Tom Smith's five-eighths, but that did not make any difference so long as one man made all the taps.

* * * Hugh Cowen found out one day that he could take five dollars' of his tap money, and buy about twenty dollars worth of taps and get good taps for his money. That settled tap making in Hugh Cowen's shop. I do not know just what led him into finding out just what his taps cost him home-made, but suspect that his tool-room, which after all consisted of a bit of paper stuck on a post, had something to do with it.

* * * It will take a picture or two, and more than a sentence or two, to tell what was the result of this sudden notion on Hugh Cowen's part, but I will add here that after two years' time I consider that Hugh Cowen's tool-room, as it has grown from a trifling start, above indicated, is now the equal, in its relation to his shop, and in its relation to the past condition of his tool arrangements, to the tool-room in any shop in the land. There is much more to be told of it. Very respectfully, CHORDAL.



LETTERS FROM PRACTICAL MEN.

Failure to Straighten a Beater Arbor.

Editor American Machinist:

I send you a little mechanical problem for the boys to solve, which is this:

Some time since a cotton manufacturer brought to my shop a beater arbor to a cotton "lapper," to be repaired. The arbor was about $2\frac{3}{4}$ inches in diameter and 5 feet long having a pulley on each end, one of which is shown in the sketch, and a journal bearing next to each pulley. Between the bearings a series of holes about $\frac{15}{16}$ inch in diameter were drilled at intervals of about eight inches, and parallel with each other. Through these holes six steel arms about twelve inches long were fitted so as to fill the holes tight at the center of the arm, where they were secured in place by pins about $\frac{5}{16}$ inch in diameter, which passed through the shaft, and through each of the arms, leaving the arms projecting equally on each side of the shaft. The ends of the arms were turned down so as to leave a pin about $\frac{3}{8}$ inch diameter, and $\frac{1}{2}$ inch long. On these pins on the ends of the arms, on each side of the shaft, a cast steel bar was fitted so as to come down on the shoulders of the pins, and the pins were riveted down into countersinks in the bars and the pins finished smooth with the surface of the bar.

The bars were finished about $1\frac{3}{4}$ by $\frac{7}{16}$ inches, and 3 feet long, being a trifle the thickest on the edges which run ahead.

This arbor was usually run at 3,200 to 3,500 revolutions per minute, and something hard had got into the cotton and went through the feed rolls and was struck by one of the steel bars, and the bar bent inwardly toward the shaft, near the center. The shaft was thereby sprung about $\frac{1}{16}$ of an inch, against *a*, *b*, so it was untrue and in this condition was brought to me to straighten.

The arbor was taken to the smith shop, placed on a fire and the bent bar carefully heated to a dull red at the bent part. It was then placed on a true leveling plate and the bar carefully straightened. Care was exercised not to heat the other parts of the beater. After it had slowly cooled it was put in the lathe, and the shaft was found to be more crooked than before the bar was straightened.

It was then put on the fire and heated a little hotter than before, and the bar hammered so as to draw it out longer, and after cooling was put in the lathe and the shaft found to be still more crooked than before. The concave or interior part of the crook of the shaft was next to the crooked bar when it was first bent, and remained in the same position after the attempt to straighten the piece. Why would not the straightening of the arm straighten the shaft? OLIN SCOTT.

Bennington, Vt.

Boiler Explosions and Coroner's Juries.

Editor American Machinist:

Engineer's views in your issue of Oct. 6, on boiler explosions, and especially on inspection, particularly the inspection of the owners of boilers, are good and worthy of attention. To illustrate: There was a nest of five boilers averaging sixty-five horse-power each, one of which exploded, killing two men, injuring two others and completely wrecking the buildings and most of their contents, entailing a loss of $20,000 or $30,000.

The boiler that exploded was a locomotive boiler (so called), and had been in use six years. A jury was impanelled, and with the coroner consisted of one active and two retired merchants, one retired hotel keeper, one real estate broker, one active manufacturer and a retired superintendent of mills, he being the only practical man of the seven. All of them were truly honorable men, but without the slightest knowledge of steam power, with the single exception named. After sitting twelve days, examining over twenty experts and witnesses, they returned a verdict, of which the following is a portion:

"And we, the jurors aforesaid, upon their oaths aforesaid, do say that * * * in manner aforesaid came to his death by misfortune, or accident. And the jurors would further say that after a very diligent and protracted hearing of facts, they are unable to harmonize the same with any theory advanced or explained to them by the experts examined in the case. The jurors would also say that the general tenor of the evidence, both of witnesses and experts, impresses them that the exploded boiler, considering its size, was not properly constructed, and the material of which it was composed was not of sufficient strength to carry a pressure of steam as high as was required of it, and the levers of the safety-valves were not properly marked and adjusted. Therefore the jurors would submit that in their opinion some very potent elements not presented or explained to them were in motion inside at the time of the explosion of the boiler under consideration, and they believe the real cause of the explosion of the boiler remains unexplained, and was of such peculiar character that it well deserves the study of all who have charge of steam boilers."

This jury of merchants not only show their lack of practical knowledge of steam, but must have had very elastic consciences, as will readily be seen by the following extracts taken from the testimony (in my possession) of the experts:

"The above named boilers were being driven to their utmost. Through some deficiency in the heater, cold water instead of hot, was pumped into the boilers. They would fill the boilers before starting in the morning, run the water as low as they dared, then shut the steam off the mill or dry house and pump up again, and so on."

"Let the old engineer go because he would not look after the machine shop besides his engine, or some other equally foolish reason, lengthened out the levers of the safety-valves, and put on one or two extra weights, so as to get higher pressure. Ran the steam up to 100 lbs., when the old engineer, who was a truly reliable man, would not go above 85."

An expert testified that the superintendent told him he intended to put in new boilers soon, and stronger ones. The master mechanic admitted, on the stand, that he had the weights moved out to the extreme end of the lever. A boiler maker testified that he examined the boiler two or three months previous to its explosion, and found four or five broken bolts, which he replaced. An expert figured up the pressure required to open the safety-valve, and reported it to be 114 lbs.

Yet this jury could not agree, but gave it as their opinion, that the boiler exploded because it was not strong enough. (There is

something laughable that a boiler should explode for that trifling cause.)

If a powder mill should blow up, killing some one, and it was brought before this jury, their verdict would probably be that some potent element was the cause. But if the powder maker escaped with his life he would persist in saying it was the powder; and so will engineers always think that the cause of this accident was too much steam on a weak boiler.

I agree with Engineer in his way of thinking that we should have inspectors for owners, superintendents and master mechanics as well as for boilers. PACKING.

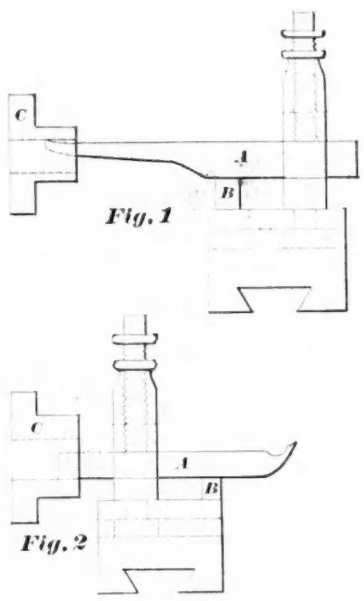


Fig. 1

Fig. 2

Truing Up Work on the Face Plate.

Editor American Machinist:

Clamping work on a lathe face plate is generally done by blocking up by "guess," then tightening and truing by the liberal use of the hammer or sledge. The following is a quick, handy way, and avoids a good deal of trouble: First, chalk a circle on the face plate, or parallel strips, the diameter of the piece to be held; then remove the washer from the tool post, and place a tool as shown in Fig. 1. *B* represents a piece of iron placed under the tool, the object being to provide a fulcrum from which the outer end of the tool may be raised or lowered by screwing or unscrewing the tool-post screw. *C* represents the work hung on the tool.

Should the piece be heavy or awkward to handle, first place it on a block, then rig the tool as shown, and hoist it. Care should be taken to balance the piece so the bottom is a little nearer the face plate than the top. Now run the carriage along and set the work to the chalk mark, moving it in or out by the cross screw and up or down by the tool screw.

Clamp, and proceed to true it up, but, instead of hammering, set a tool as shown in Fig. 2, in which *A* represents the tool, *B* the fulcrum, and *C* the work. The chalk marks being at the top, screw down the tool screw, and notice the distance the work moves on the face plate. It will take a few trials to get the "knack," but after that it will be found a very rapid process. There is no danger of hammer marks on finished work, or breaking the arms of pulleys.

When a number of pieces of the same size are to be chucked in succession, I get the first one right, then put short bolts through the face plate, the heads set just against the edge of the work. This guides the next piece, and also prevents slipping.

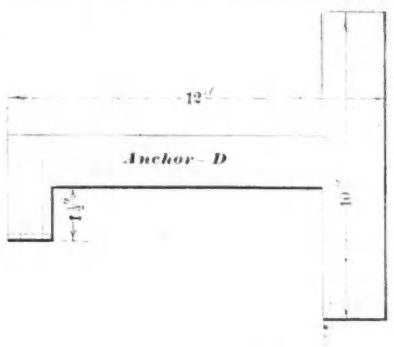
P. C. FORRESTER.

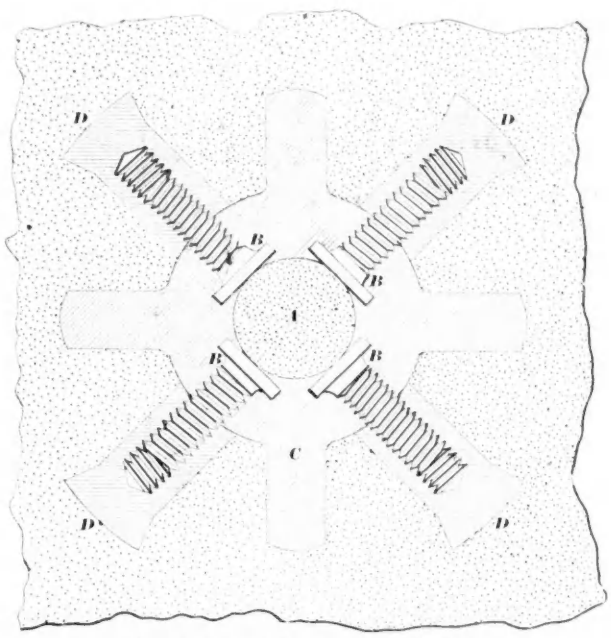
An Average Fire Equipment.

Editor American Machinist:

I send you a sketch of the fire equipment of too many shops in the country. It consists of a shelf on which, most likely, may be found a roll of old belting, a handful of nails, a few odd bolts and nuts, and a bucket-hoop, over all of which may be seen on a board, which is nailed to the wall, "To be used for fire only."

J. E. MCCONNELL.





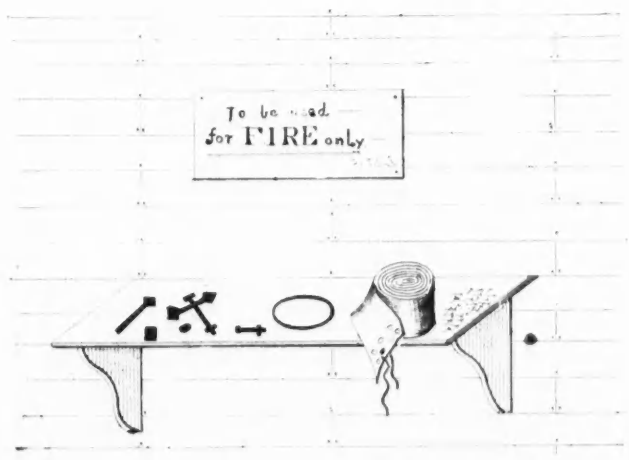
ANCHORS AND CHAPLETS FOR CORES.

Anchors and Chaplets for Cores.

Editor American Machinist:

Not long since I had a casting to make in which was a core that, owing to its peculiar situation and length, had to be secured by chaplets. In the largest sketch a sectional view near the end of the hub of this casting is shown. In this *A* is the core, *B* the chaplets, *C* casting, and *D* anchors of cast iron, shown in the plan in small sketch. It will be seen that owing to the ribs on the hub it was impossible to use chaplets over the top of cores and the space between the ribs—about four inches—made placing or driving them in the bank hazardous: So I made castings, *D*, and had them drilled and tapped ½", and the stems of the chaplets, *B*, fitted to them. These anchors were placed down on the pattern when ramming up mould, laying iron rods across the top of them to keep them firm. When the pattern was drawn out of the side of the mould, the ends of the anchors, where tapped, were even with the hub. (The core laid horizontally in the mould and the sides were lifted away in order to get the hub out, and set and secure the core.) The chaplets were screwed into the anchors, and the core brought to its correct position by the bottom ones, and the top ones screwed down to the core. When all were screwed to place the core was as rigid as could be desired. These anchors performed so perfectly what was required of them, and being inexpensive, it occurs to me that they may be used to advantage under other circumstances. Many castings are lost by wedging down chaplets, and many risks are taken in not using them. In this instance there were so many corners and tender places that an ordinary chaplet would increase the risk of losing, but by this method there was no risk, and the anchors helped to hold the sand and secure the mould. Of course the body of the anchor, beyond the screwed end, can be made in form and dimensions to meet the circumstances.

FOUNDRYMAN.



A SPECIMEN FIRE APPARATUS FOR MACHINE SHOP.

Meeting of the Society of Mechanical Engineers.

The annual meeting of the American Society of Mechanical Engineers commenced in this city on Wednesday evening last, when T. R. Pickering read a paper on "American Machinery at Foreign Expositions." Mr. Pickering has been the American representative at many foreign expositions, and he is quite familiar with his subject. He considered that exhibitions gave good facilities for introducing our machinery into foreign countries and bringing out its peculiar merits. Although our government had been extremely apathetic in pushing American manufactures into notice along with the products of other nations, private enterprise had in some measure done what the government neglected.

At the Paris Exposition of 1867, machinery made by Sellers & Co., Brown & Sharpe, The Pratt and Whitney Co., J. A. Fay & Co., and others had attracted great attention, and the wood working machines especially were more favorably spoken of than the exhibits of any other section. American locomotives had carried off all the honors. For this exposition, Mr. Corliss offered to put up one of his engines to supply the motive power for the American section, and it was declined mostly through the discourtesy of the American Minister in Paris. Instead of trying to aid and advance American interests that minister and the American Minister who was at the Court of Vienna in 1873 seemed to do their utmost to depreciate American manufactures, and to throw obstacles in the way of American exhibitors.

The Massachusetts Commissioner to the Vienna Exposition reported that the American exhibit there would not reflect credit on a second-class country fair, and the American Minister paid no attention to his country's interests. But the ablest German and Austrian engineers were enthusiastic in their praises of the American tools. Some of Sellers' machines were declared by the highest authorities to be built "according to the severest theoretical abstractions, the highest order of mechanical ability being displayed in their design." This opinion was indorsed by the managers of the Exposition, and the influence of these opinions brought American tools so prominently into notice that they became the patterns for tool-makers all over Europe. Even Paris papers commended American machines as furnishing more original matter for study than those of all the other sections together. The Emperor of Austria, Prince Bismarck and other dignitaries, expressed themselves deeply interested in the American exhibit, and examined the machinery with minute attention. After the commendation of these celebrities, our minister found leisure for the first time to look through the American section.

At the Paris Exposition of 1878, American machines were as popular as they had been at other displays. Here a Brown & Sharpe Universal Milling Machine was awarded the highest honors, and a leading English firm got a second class award for a similar machine. They protested against Brown & Sharpe getting the higher award, and the judges replied, that "copies were not entitled to so high an award as were originals." At all the other national expositions, American exhibitors enhanced the good name of our manufactures, and the ability of the American workman is by this means becoming recognized all over the world.

At the business meeting on Thursday Prof. John E. Sweet (the founder of the society) was elected president. This is an honor fully merited. It is a well-known fact that his modesty has prevented his accepting the office until now. He could not, however, decline year after year, considering the unanimity with which he was urged to accept it.

The membership was increased by some thirty-seven names, making 456 now on the roll.

Several valuable papers were read on Thursday and Friday (evening), which we shall refer to hereafter.

An excursion to Stamford, Conn., and a visit to the Yale & Towne Mfg. Co.'s works, where one of the Emery testing machines was much admired, occupied most of the day on Friday.

By the courtesy of the N. Y. West Shore & Buffalo Railroad, the society made an excursion to Kingston, N. Y., on Saturday, in a special train, and were greatly pleased with the trip.

T. B. Merrill, of Portland, Me., writing to the Cincinnati *Marine Journal*, on the subject of the Portland Steam Packet Company's boats, says the company employs no brass-checked clerks or rum-soaked captains or engineers. Their employes, who manage the work, are men of good character and of well-known ability. Many devices connected with the management of engines and boilers have been invented by employes of the company, and in many instances they were afterwards taken up by outside parties and patented. It makes some of our engineers grin, to have fellows come round with old worn-out ideas newly ground up through the Patent Office, and presented as the best and newest thing out. It is only a few months since a patentee of a steam jet turned up here, offering to save 90 per cent. of fuel by his invention, which was precisely the same thing that had been thoroughly tried by us twenty years ago and discarded as worthless. Here the well-known gag attachment to the Stevens valve motion had its origin, but a New York man afterwards patented it and made a little money out of it. Here the rubber back packing, and also the elastic slab as a backing for the hemp packing was invented and adopted, and is still in use. Here also the use of hard lubricators under compression were first brought out.

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NEW YORK, NOVEMBER 17, 1883.

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The price of the AMERICAN MACHINIST was reduced, beginning with issue of Nov. 3, to five cents a copy, or $2.50 a year. Readers who do not find copies for sale by newsdealers in any part of the United States or Canada where they have asked for this paper, will confer a favor by dropping us a line about it.

A Growing Industrial Problem.

An industrial problem which, although not of universal interest, is growing in importance every year, presents itself to the people of many cities and towns that have decided to offer substantial encouragement to manufacturing establishments to locate within their borders. When that encouragement takes the form of open individual donations or subscriptions to stock, the problem is settled when the industry is located and started. When, on the other hand, it is decided to exempt the new industry from taxation for a term of years, or to donate to them money or bonds out of the public treasury, the problem is not so easy of solution. The injustice of requiring old-established manufactories to pay full taxes and allowing the new ones to go scot free, is apparent to anybody. The former must necessarily pay even more than their proper proportion by reason of exempting the latter from paying any tax at all. The exemption may be agreed upon by nearly every citizen at first, but sooner or later dissatisfaction will crop out. This naturally leads to testing the legal right of towns and municipal corporations to make such exemptions, and occasionally a productive establishment, after locating and starting business, finds itself cut off, by a decision of the court, from the special privilege that determined their location.

An important legal case, growing out of the donation of city bonds to a manufactory in Corry, Pa., has lately been decided by an arbitrator. The city had no right to issue bonds except for "a corporate or municipal purpose." It issued ten years ago $100,000 of bonds ostensibly for such purpose, but really to present to a new manufactory thereby enticed to locate in Corry (the concern finally went into bankruptcy). Holders of these bonds brought suit against the city, which had refused to pay them. The arbitrator decided that the bonds were void, because the officers of the city had no right to issue them, and the holders could not recover anything, although they had purchased them for a valuable consideration in good faith and presumably without knowledge of the real purpose for which they were issued. The arbitrator, however, declared that the holders could have learned the true purpose of issue by examining the records of the city government. This decision is likely to cause a great deal of uneasiness in some other localities where bonds have been donated to private industrial enterprises. There are several unquestionably correct ways to aid new manufactories looking for locations. Let those methods prevail, and no trouble need be anticipated in the future.

Condition of the Iron Trade and General Productive Industries.

A great deal of verbiage has been published during the past two or three weeks by papers in the iron interests, as to the decline in prices and demand, and the uncertainty surrounding the future of the iron trade. A gloomier view is taken than the circumstances warrant. Leading journals have furnished long lists of idle furnaces, and have given statistics showing the relative falling off in production, and have drawn the conclusion therefrom, that the iron trade is on the down grade; consumers, in consequence, have become more or less alarmed, and have been following the conservative policy of purchasing for current requirements, and deferring the usual large transactions until prices reach their lowest possible limits. The fact should, however, not be lost sight of, that the Pennsylvania furnaces, especially, have had a long and prosperous run for a year or two, and have been selling their entire output at good prices. The reason for the blowing out of most of the furnaces which have recently gone out of blast, has not been altogether low prices, but mainly to make necessary repairs, and in some cases, to inaugurate improvements which will enable the companies to make better and cheaper iron in competition with irons from other localities which are now threatening the market. The restriction is more voluntary than involuntary, and in a few weeks they will probably resume, in better shape than before. In the meantime, consumption still absorbs a large part of the surplus stocks and places makers in a better position than were they to continue production and depress the market by additions of stocks: this fact should be borne in mind by consumers, and they should not be deceived by the simple fact of so many furnaces suspending production. Southern irons are crowding their way into the market, and are selling at $15 to $18, according to the point of delivery.

Rolling mills have a smaller volume of business on hand now than at any time for four years. This is due, not so much to the fact of any actual falling off in consumptive requirements, as to the apprehensions created in the minds of buyers as to lower prices; but, taking the market all in all, the consumptive requirements are sufficient to engage the bulk of producing capacity. Prices range from $1.75 at Pittsburgh to $2.10 in Philadelphia and $2.20 in New York City. Orders are coming in slowly, and buyers exhibit the usual caution in supplying their wants.

Negotiations have been going on for several months for large blocks of steel rails. Buyers are endeavoring to place contracts at $36 to $36.50, and makers, so far as known, name $37 as their minimum price. The trunk lines are in the market for supplies, and have placed small orders at the latter figure.

The new railroad mileage so far this year is about 5,000 miles. The remainder of the year will be devoted to the completion of a multitude of short lines, and the construction of side tracking for the accommodation of the increasing freight traffic. Nearly all the huge enterprises inaugurated within the past two years have been completed, and very few others are projected. Most of the projected mileage consists of short lines of from 50 to 200 miles, connecting other roads, and intended to develop local traffic. The outlook for railway construction is not so bright as heretofore, and, according to surface indications, the mileage next year will not be greater than this, especially if speculation should turn in the wrong direction. Capital and enterprise will wait for the growth of population and traffic, and the expansion of manufacturing industries and agricultural producing capacity.

Productive industries at large are in good shape, and, with wisdom on the part of the manufacturing interests, and fairness on the part of the controllers of transportation and the agencies for the exchange of products, there should be little cause for apprehension of any general downward tendency in trade or commerce. On the other hand, the consumptive requirements of the people of this country are large and increasing; their wealth-producing capacity is improving year by year, and instead of needing less they are constantly needing more. The average consuming capacity of the American citizen has been growing steadily ever since the war gave an impulse to industrial activity and commercial enterprise, and that expanding tendency has been the strongest stimulus in leading to fresh investments and to the opening up of new avenues for the employment of labor and capital. The south is making up for lost time, and is coming up to the standard of industrial energy and enterprise, and is widening the fields for the profitable investment of capital.

Our industrial prosperity depends for its permanency upon factors, agencies and influences outside of, and beyond it. Among these are: A proper financial system; a proper bankrupt law; the lowest possible taxation; the largest possible export trade, and the fairest possible railway rates consistent with the rights of corporations and the general public. A number of these problems will come up for consideration before the next Congress, and it is to be earnestly hoped that narrow party considerations and restricted views as to great public questions will not prevail, but that the interests of the people and of American capital and labor will receive the consideration to which they are entitled. Congress has important duties to perform, and public opinion will hold it to strict account. Our industries are expanding rapidly in all directions. The great west and the great south are absorbing the surplus capital of the east, and the brains and energy of the country are finding abundant employment in developing latent resources. This great revival must not be arrested nor obstructed.

Probably a machinist is no more hampered in what he *wants* to do than any other manufacturers, but it sometimes appears to him that he is. Said a well-known manufacturer recently, speaking of a new machine tool he had brought out: "That machine needs one addition (naming it) that would cost less than twenty dollars. Every one who knows anything about such a machine knows it, and will admit the advisability and value of the addition; but the difference between the price at which I can sell it in its present state and the twenty dollars advance in price to cover the increased cost, demands that the addition be left off, for the present, at least." Manufacturers are not slow to learn—and they have abundant opportunities—that there is a material difference between finding improvements appreciated, and hearing good words about them, and finding customers even amongst those who approve, that are willing to pay for the things they appreciate. If those who note a lack of some features in a tool or machine were to study the matter from the manufacturer's point of view they would often find the reason, and find it quite different from what they expected. Generally the manufacturer is the first to see it, and regrets more than any one his inability to make use of and get paid for it.

Some months ago we published a few communications on speed in turning shafting, from Wm. Shanks, of Thomas Shanks & Co., machine tool builders, Johnstone, Scotland; some remarkable results in rapid shaft turning on one of their lathes, were mentioned. At our request, Mr. Shanks has kindly sent us a photograph and detail drawings of one of their large lathes, from which we have had the engravings made on our first and second pages this week. The representation of this lathe will be of especial interest to our machine tool builders.

The communication which we publish in another page, describing the evening school for apprentices connected with the Brooks Locomotive Works, gives particulars of a benevolent enterprise well worthy of wide imitation. All other industrial nations are recognizing the advantages that accrue to the community from the workmen's being instructed in the science of their business, and in most countries facilities are furnished for artisans to obtain special technical instruction. In this respect we are too much inclined to rely upon individual ambition or private benevolence to supplement the work of the public schools. The result is that our artisans do not enjoy the educational advantages extended to the workmen in countries that are competing with us in the race of industrial production. Some of our States that have for many years received the material advantages arising from prosperous mechanical establishments have done absolutely nothing to train the rising generations of workmen in the higher branches of their business. When young mechanics receive instruction in the technicalities of their work, the result is combined knowledge and skill. These are the men who in the future will lead our mechanical enterprises, and the States that afford governmental encouragement and aid to their youth in this direction will have the start in maintaining business prosperity.

Every time the driving wheels of locomotives belonging to the New York Central Railroad are put in the lathe to have the tires turned up, the holes for the crank pins are trued by the quartering machine. Were this practice more general, there would be fewer broken side rods.

Literary Notes.

We have just received a copy of the first number of the special illustrated edition of *Building*, published by William G. Comstock, 6 Astor Place, New York. It is very profuse in its full-page photo-lithographs of dwelling houses, churches, office buildings, &c., also views of interiors. The magazine is well edited, and must prove very interesting to those interested in building.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(259) S. W. C., Indianapolis, Ind., asks: How can I make ink for labels, that will not be affected by acids? *A.*—Try a mixture of one part pure Trinidad asphaltum, with four parts of oil of turpentine, colored with plumbago.

(260) M. C., Ypsilanti, Mich., writes: We want to know if there is a way of getting the horse-power of a small engine by means of a lever and weights, and how to do it? *A.*—You will find this fully explained in the AMERICAN MACHINIST of April 10, 1880.

(261) S. W., Baltimore, Md., asks: Can you give me the address of James Nasmyth, the inventor of the steam hammer? *A.*—We are unable to give his exact address, but a letter addressed to James Nasmyth, inventor of the steam hammer, Manchester, England, will be sure to reach him.

(262) C. H. H., Chicago, Ill., asks: 1. What percentage of condensation will there be in carrying steam through a 3″ steam pipe a distance of 600 feet, the pipe being covered with asbestos, or a covering equally good? *A.*—See an article on this subject in the AMERICAN MACHINIST of June 9, 1883. 2. What is the best way to lessen the loss? *A.*—Cover the pipe.

(263) B. W., Yonkers, N. Y., asks: 1. In cutting dies with their cutting edges on line with the centers, should they be cut with a hob larger or smaller than the bolt to be cut, and how much? *A.*—Larger; for medium sizes of bolts 1-64″ will answer very well. 2. In cutting a worm gear with a hob, is it proper to allow the hob to feed the gear around? *A.*—This is done a good deal on ordinary work, but it is better to have the gear fed positively.

(264) J. S., Racine, Wis., writes: 1. I have had an argument with a party who claims that it is wrong to run pipes through a boiler front for gauge cocks, because the draught will affect them in such a way as to make them show more water than there is in the boiler. Is he right? *A.*—We have never heard any complaint from gauge cocks put in in this way, and have had considerable experience with them. 2. Do you approve the gauge cocks, water line, and steam gauge all in one casting connected with boiler at top and bottom? *A.*—We approve of having one set of gauge cocks connected each by itself in the boiler.

(265) E. Q., Columbus, O.: I have a stationary engine 20″x42″, running 44 revolutions per minute. The steam ports are 1 9-16″ x 18¼″; exhaust port, 3 15-16″ x 18¼″. From outside to outside edge of steam ports is 10 1-16″; travel of valve, 4¼″; boiler pressure, 60 lbs. The engine drives a line shaft by spur gearing, the line shaft running 132 revolutions. Have had some trouble with backlash in the gears. Have tried valve with 13-16″ outside lap and 1-16″ inside lap; also one with 1 1-16″, outside, 11-16″ inside lap, and 1 1-16″ outside, and 1-16″ inside lap. How are these proportions, and has the valve the proper travel? *A.*—The travel is about right for 13-16″ outside laps. If the engine is inclined to pound, give ¼″ or more inside lap. If it runs still, 1-16″ is better. With the proportion of ports you could use the 1 1-16″ lap, or more, but the travel should be increased so as to open the steam port as far as you now do with the 13-16″ lap; that is, for all the lap you add beyond 13-16″ you should increase the travel of the valve by twice the amount of lap added. This is not, however, the cause of the back-lash complained of. That is probably caused by too light fly-wheel.

(266) G. J., Chattanooga, Tenn., writes: In figuring on the horse-power of a double leather belt, both pulleys being 36″ in diameter, and the speed 90 revolutions per minute, I took the rule by Chas. A. Hague, in the AMERICAN MACHINIST of September 23, 1882, and I make the horse-power 92.9. My friend thinks I have not worked according to the formula. Please look over the figures and see if I am right. *A.*—The formula referred to is:

$$\frac{4\ D\ 3.14}{10} \times W\ T\ F \div 33000 = H.\ P.$$

In this formula D = diameter of pulley.
W = width of belt.
T = decimal in the table.
F = feet traveled per minute.

Substituting the values and working out the equation:

$$\frac{4\times36\times3.14}{10}\times12\times.80\times847.80 \div 32000 = 11+$$

horse-power.

(267) W. N., Flint, Mich., writes: We have a boiler 6 feet diameter and 24 feet long, with 25 feet grate surface, and run a 100 horse-power engine (16″x24″) at about ¾ its capacity. The boiler has four ten-inch flues from the fire-box to back end of boiler, and two fourteen-inch return flues. From these the gases drop down and pass back again under the shell, then down again to a flue that leads to the chimney. In addition to the steam for the engine, we sometimes take steam through an 1¼-inch pipe—all that will pass—to heat dye vats; besides all the exhaust is used for this purpose. We have been burning pine slabs, and the flame reached nearly through the return tubes, but now we want to burn coal, but find difficulty in making steam. What I want to know is, if the draft can be helped by turning the exhaust into the smoke-stack about 10 feet from the base? The base of chimney is of brick, and the rest, from about 10 feet up, of iron 2½ feet diameter. Would it do to connect the exhaust jet at the bottom of the iron pipe, and do you think it will help out with steam? *A.*—You will be able, by putting in the exhaust jet, to make more steam, and perhaps it will help you out. The difficulty will be in losing the exhaust for heating. We should connect with a two-way valve, so that a small part only of the exhaust need be used in the stack. You seem to have a very good boiler, but hardly enough boiler capacity. The exhaust jet is worth trying.

(268) A. H., Philadelphia, Pa., writes: I made a 48-inch belt 69 feet long. On the first trial the belt ran off at the same side of both pulleys about two inches. I turned the belt end for end, running against the laps, but the belt ran off the same side. I then put a level on the fly-wheel, and found it necessary to block up under one side to bring the bulb in the center. I claimed that the trouble was in setting the engine, or in turning the fly-wheel, and that had the belt been crooked it would have travelled off the fly-wheel on one side and the pulley on the other side. What is your opinion? *A.*—Your experiments, if correctly described, seem to show that the trouble is not with the belt. The belt will run, as you state, from either of three causes, viz., the shafts being set out of level, the shafts being nearer together at one end than at the other, or the fly-wheel pulley not being crowned properly in turning. We should say, from your description, that the trouble was from one or the other of these causes. You can determine if the fly-wheel pulley is turned true by measuring around it with a steel tape at each edge, and at other points at each side of and at equal distances from the center. A level on each shaft will show whether the shafts are level, and by tramming between the shafts you can determine if they are the same distance apart at each end. If the fly-wheel pulley is not turned properly, you will find it difficult, or impossible, to make the belt run as it should.

Business Specials

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

"Tack Machinery"
Willets Manufacturing Co., Providence, R. I.

Steam Engine Castings, ½ and 1 H. P. Samuel Harris & Co., Canal st., Chicago, Ill.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 144 LaSalle st., Chicago, Ill

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 58,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, and 1882. A limited number of each sent by express for $3.50 per volume, express charges to be paid by purchaser. AMER. MACHINIST Publishing Co., 96 Fulton st., New York.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Manufactures.

The Wharton Switch Company is enlarging its shops at Jenkintown, Pa.

A woolen factory is to be erected at Washington lane and Chew street, Philadelphia.

Charles E. Brown will erect a machine shop at 22 to 26 Artisan street, New Haven, Conn.

The Yotokeft Mills Company, Accum, Conn., will erect an addition to their cotton factory.

Horn Brothers will erect a brick factory, to cost $7,000, at 281 West Superior street, Chicago.

The Indiana Foundry Company, Indianapolis, are at work on their new buildings, which are 280x150 feet.

R. Dunbar & Son, Buffalo, N. Y., have completed the first lot of Gardner engines having an automatic cut-off.

Wm. Brookfield will erect a brick factory, to cost $8,000, on Maujer street, near Waterbury street, Brooklyn, N. Y.

Robert Sternhardt will build a three-story brick factory at 11th avenue and 37th street, New York, to cost $10,000.

The Stewart Heater Company, Buffalo, N. Y., have commenced to manufacture a new double-plunger boiler feed pump.

A. M. & D. Gibson, Chicago Ill., are making a specialty of vertical drill presses, having abandoned the manufacture of axles.

The Plano (Ill.) Manufacturing Company expect to employ over 500 hands next season in the manufacture of agricultural machinery.

The Pratt Manufacturing Company will erect a brick shop, to cost $13,000, at North Eleventh and First streets, Williamsburgh (Brooklyn), N. Y.

By a recent reorganization the Union City (Pa.) Iron Works becomes the Warden Machine Works. They make portable and stationary engines a specialty.

The new shop shortly to be erected by D. B. Closson, at Easton, Mass., will be 135x35 feet, and four stories, including the basement, with a mansard roof.

At Millbury, Mass., Robert Miller is building a mill, 40x30 feet, and three stories, which is to be run by a 30 horse-power engine. It will be completed the 1st of January.

A factory for the manufacture of sand-pipes and fire-escapes is being erected in Chicago, Ill., by Matt Benner. The factory will be four stories high, 150x56 feet, and cost $30,000.

The Glen Rock (Pa.) Manufacturing Company has been chartered under the laws of the State, for manufacturing agricultural implements in York County, with a capital of $40,000.

The new works of the Marchand Manufacturing Company, at Pittsburgh, Pa., are now in operation, and are turning out about forty per day of their rotary self-measuring pumps.

The Covert Manufacturing Company, West Troy, N. Y., hardware manufacturers, will erect a 73x40-foot addition to their shop, three stories high. An additional engine and boilers will be put in.

J. W. Walker is erecting a structure 144x100 feet, at Forty-seventh Street and Alleghany Valley Railroad, Pittsburgh, Pa., for a new bridge works. It is expected to be in operation in a few weeks.

James C. Cunneen has resigned as superintendent of the Laurel Lake Cotton Mill, Fall River, Mass. It is understood that Mr. Cunneen has about $300,000 pledged towards the construction of a new mill.

The Railway Speed Recorder Company, of Kent, Ohio, have enlarged their works by a new brick foundry room, 40x80 feet; a new pattern shop, 30x80 feet, and are running night and day on orders.

The Buffalo Steel Foundry (Pratt & Letchworth), Buffalo, N. Y., have just sent four handsome steel gears across the Rocky Mountains, each weighing four thousand pounds, while eight more are to follow.

Pratt & Cady, Hartford, Conn., are the manufacturers of the swinging check valve illustrated in last week's issue. They erected, not long since, new shops in which to manufacture this and other specialties.

The Abendroth & Root Manufacturing Company, of New York, are about to enlarge their works at Greenpoint, the present facilities being inadequate to supply the demand for spiral riveted pipe and water-tube boilers.

The product of the Phœnix Factory, Peterboro', N. H., is sold ahead three months. The present agent is William Ames, who has reorganized the mill workings, and now contemplates the introduction of a steam engine, in order to be more certain of the needed power.

The woolen mills of Vassalboro, Me., are to introduce steam, as they can no longer depend on the water supply. There have been very many complaints among manufacturers who depend on water for motive power, and a large number are now determined to provide steam engines for driving their mills.

Mr. Rylands, of Codd & Rylands, while on a recent visit to this country, was so much impressed with the merits of the Albro-Hindley screw elevator, built by Clem & Morse, Philadelphia, which he had seen at various points during his travels, that he ordered one for their works at Barnsley, England.

The Columbus (O.) Rolling Mill has been sold to a Milwaukee syndicate, headed by General Irwin McDowell, for $175,000. The purchasers are the owners of a patent by which they claim they can convert ordinary pig iron into muck bar without the necessity of putting it through the expensive process of puddling.

The T. M. Mandt Manufacturing Company, Stoughton, Wis., whose works were burned out last winter, has been reorganized with $250,000 capital, and is building new works. The machine shop and blacksmith shop is 200x48 feet. One hundred and fifty men are employed, which force will shortly be increased to two hundred.

A wood fiber company has been organized at Gardiner, Me., with a capital of $1,000,000, to make a patented machine, which, it is claimed, will turn out fiber much cheaper than by the present process of grinding the wood. Geo. F. Morse, of Leominster, Mass., is president; C. A. Parks, of Boston, treasurer, and Gov. Hale, of New Hampshire, among the trustees.

The *Northwestern Lumberman* says: Sam Quaw will build a planing mill at Wausau, Wis.; J. M. Johnson, a saw and planing mill at Freedom, Ind.; W. W. Cloud, a planing mill at Blytheswood, S. C.; Dalton & Stover, a large saw-mill at Menominee, Mich.; Moses Wadleigh, a steam saw-mill near Oldtown, Me.; and Boyd Caldwell, a saw-mill at Caldwell Lake, Ont.

Horace Thurston, 84 Clifford street, Providence, R. I., has started a machine shop for the manufacture of fine tools and special machinery, including tools for jewelry manufacturers. Mr. Thurston has been foreman for Brown & Sharpe Manufacturing Company for several years, and announces that, having put in a line of tools made by that company, he is prepared to do work of a character not done in ordinary machine shops. He also intends to take apprentices.

The *Woolen Manufacturer* says: "Although Texas is not a manufacturing State, there is a strong feeling there in favor of manufactures. There is a cotton mill at Bastrop, and others at Waco and Terrell. All these mills are in prosperous circumstances. In these, as, indeed, in all the manufacturing enterprises in Texas, nearly the entire capital invested is home capital. There is also a woolen mill at New Braunfel, in Comal County, which contains the latest improved machinery, and is operated by skilled hands. It uses only Texas wools, and its manufactured goods give general satisfaction, and are, in fact, in demand in Boston and New York. The capacity of this mill, which is run by water power, has lately been increased."

H. H. Perkins, Kewanee, Ill., writes us: "Allow me to correct a little error in regard to the rolling mill here in our place. You say in your paper of November 3d that the new building for the rolling mill of the Haxtun Steam Heater Company, at Kewanee, Ill., is 75x200 feet, with an L 60x75 feet, and that it is built entirely of brick, which is not anywhere near correct, neither in material nor size. There are two buildings, 60x200 feet, one with an L 60x75, and the other with an addition 35x90, besides the boiler-house and three or four small additions. All are made of heavy framed timbers, and covered throughout with corrugated iron. The machinery is nearly all set, and will be run by three large Corliss engines—one 400, one 150 and one is 100 horse-power—besides three smaller engines for driving shears and other machines."

Machinists' Supplies and Iron.

New York, November 1, 1883.

The supply trade remains quiet. In American iron we quote: No. 1 X Foundry, at $20.50 to $21; No 2 X, $19 to $19.50. Scotch Pig—Coltness, $23.25; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $22.50; Eglington, $20.50 to $21. These prices are at yard; prices are quoted to arrive at $0.50 to $1.00 less.

Copper—Lake, 15c., to 15¼c.; other brands, 14¼c. to 14¾c.

Lead—Common Pig, 4.15c.; Refined, 4.20c.

Spelter—Refined, 8c. to 8¾c.

Tin, in jobbing lots—Banca, 21½c.; Straits and Malacca, 20¾c. to 20⅝c., with light sales.

In boiler plate we quote prices as follows: Tank, 2½c. to 2¾c.; Refined, 2¾c. to 2 9-10c.; Shell, 3¼c. to 3⅜c.; Flange, 4¼c. to 4⅜c.; extra Flange and Fire-Box, 5¼c. to 5½c.; Siemens Steel Plate, 5½c. to 6c.

☼WANTED☼

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Situation as lathe hand; fine work. Dan'l Ketscher, 178 Varet st., Brooklyn, E. D., N. Y.

Wanted—Situation as Foundry Foreman, thirty years' experience; sixteen, as Foreman. Accustomed to all kinds of work, both light and heavy. Address, Foreman, care American Machinist.

Wanted—A first-class foreman in a hay and manure fork shop. Must understand the business and come well recommended. Address, by letter only, Foreman, care of William Young, 21 Park Row, New York.

A mechanical draughtsman, experienced in designing machinery and superintending its erection, desires a situation. Specialties: Motive power, pumping machinery, and mill work. Address P. O. box 326, Moorhead, Minn.

A German gentleman of means, with excellent connections, a graduated engineer, speaking French, English and Italian, would like to engage in a large manufacturing business in this country, or act as an agent for the sale of American machinery in Europe. Address, P. P., care Bates Advertising Agency, 41 Park Row, New York.

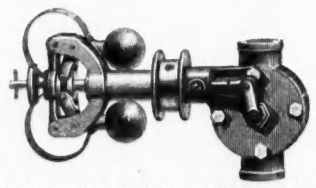
Wanted—A situation as foreman of boiler shop. Has had large experience in every variety of boiler work and the management of workmen; knows how to work men and tools up to their full capacity; can make drawings and estimates correctly; understands locomotive and railroad work thoroughly. First-class references. Address, Boilermaker, American Machinist Office, N. Y.

Wanted—Light machinery to build, by a company who have ample power and room. Address, Box 1,024, New Haven, Conn.

Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

Corliss Condensing Engine for sale. 18"x42" cylinder; wheel, 18 ft.; diameter, 26" face. In thorough order; used less than one year. Also a great variety of portable and stationary steam engines and boilers, both new and second-hand. S. L. Hoit & Co., 67 Sudbury street, Boston, Mass.

WRIGHT MACHINE CO.
WORCESTER, MASS.
Manufacturers of
STEAM ENGINE GOVERNORS

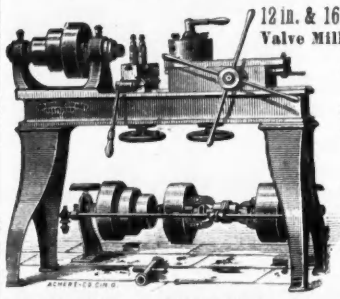


WATER WHEEL GOVERNORS
NOISELESS DOFFER COMBS.

COOKE & CO., DEALER IN
Machinery & Supplies,
22 CORTLANDT ST.,
NEW YORK.

AGENTS FOR THE
Greenfield Vertical Engines
2½ to 30 Horse Power.
Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.
ALSO
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

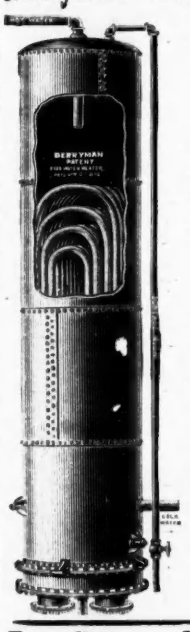
BRASS WORKING MACHINERY.



12 in. & 16 in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests
Revolving Chucks for Globe Valves,
Two-Jaw Chucks,
Small Tools and Fixtures.
WARNER & SWASEY, Cleveland, O.

"COMPOUND" BOILER;
HOW TO USE IT AND RUN IT AT SEA.
Explaining causes of all corrosion and the formation of scale, with instructions for its entire prevention, together with useful information for maintaining Steam at Sea. Illustrated. By a Sea-going Engineer. 8vo, paper, 40 cents.
E. & F. N. SPON, 35 Murray St., N. Y.

THE Berryman Pat. Feed Water Heater & Purifier



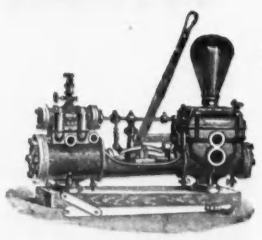
Manufactured by
I. B. Davis & Son,
HARTFORD, CONN.
Has seamless drawn brass tubes. The U shape of the tube prevents their being affected by expansion or contraction.
This Heater has been in constant use Ten Years.
None have ever required repairs. Gives the highest results attainable by the use of exhaust steam.
IT IS ALSO THE ONLY HEATER APPLICABLE TO CONDENSING ENGINES, increasing the vacuum and imparting a high degree of heat to the Feed Water.
Benjamin F. Kelley,
AGENT,
No. 91 Liberty St.,
NEW YORK.

By Samuel Hatch & Co.
Office, No. 9 Congress Street,
BOSTON, MASS.
LARGE SALE OF MACHINERY, ENGINE, PUMP, SMALL TOOLS, BENCHES, &c., &c.,
On Thursday, Nov. 15th, at 10 o'clock, A. M., at Store No. 174 Oliver Street, Boston, a large stock of Machinery, consisting in part, of 32 Lathes, 7 Planers, 10 Drilling Machines, 3 Pulley Machines, 4 Milling Machines, 4 Emery Wheel Machines, 1 Gear Cutting Machine, 1 Bolt Cutting Machine, and a large lot of small tools.
SAMUEL HATCH & CO.

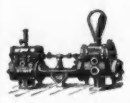
SPECIAL MACHINERY
Of light and medium weight made complete for use. Machines invented and designed and made to work in any practical purpose.
C. WING, Pattern Maker, Greenfield, Mass.

The Craig Double Sight Feed Lubricator Co.
LAWRENCE, MASS.
MANUFACTURERS OF THE
Craig Double Sight Feed Lubricator.
The Cheapest, Simplest and Most Complete Lubricator on the Market.
Shows the oil going up and the water coming down.
Send for Circular and Prices.

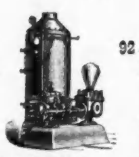
KNOWLES PATENT STEAM PUMPS.
THE STANDARD!



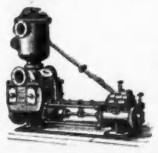
THE BEST MADE PUMP! THE BEST PUMP MADE!
Estimates furnished on application for Pumping Machinery of any capacity, and to work against any pressure.
Air Pumps and Condensers for Steam Engines a specialty. Will save from 20 to 30 per cent. fuel.
SEND FOR ILLUSTRATED CATALOGUE.
Address KNOWLES STEAM PUMP WORKS
98 Liberty St., New York, and 44 Washington St., Boston, Mass.



The Deane Steam Pump Co.
HOLYOKE, MASS.
Send for new Illustrated Catalogue.



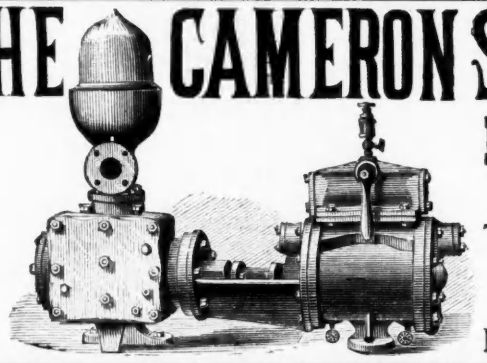
92 & 94 Liberty St. NEW YORK. | 54 Oliver St. BOSTON. | 49 N. 7th St. PHILA. | 226 & 228 Lake St. CHICAGO. | 620 & 622 N. Main St ST. LOUIS.
MANUFACTURE
INDEPENDENT CONDENSING APPARATUS A SPECIALTY.



STEAM PUMPING MACHINERY
For Every Possible Duty.

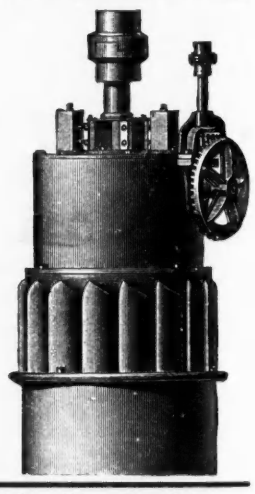
UNION STONE COMPANY,
Patentees and Manufacturers OF THE
UNION EMERY WHEEL.
EMERY, EMERY WHEEL MACHINERY AND TOOLS A SPECIALTY.
Automatic Knife Grinding Machines, Wood Polishing Wheels, Grinders' and Polishers' Supplies.
Catalogues on application. 38 AND 40 HAWLEY STREET, BOSTON, MASS.

THE CAMERON STEAM PUMP.

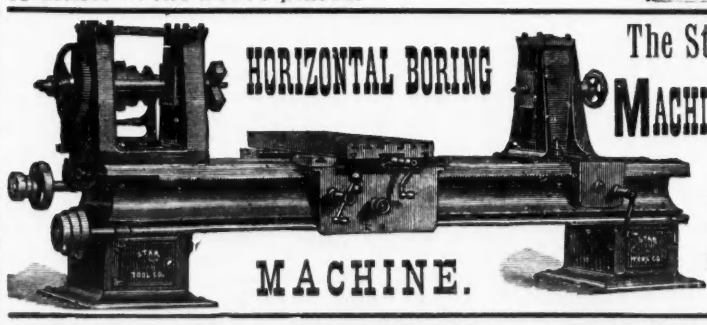


Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON
Steam Pump Works,
Foot of East 23d St., NEW YORK.

THE HERCULES TURBINE
Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.



—BUILT BY—
THE HOLYOKE MACHINE CO.
SHOPS AT
Holyoke and Worcester, Mass.
Send for Catalogue, Circulars and Price List to either of the above places.



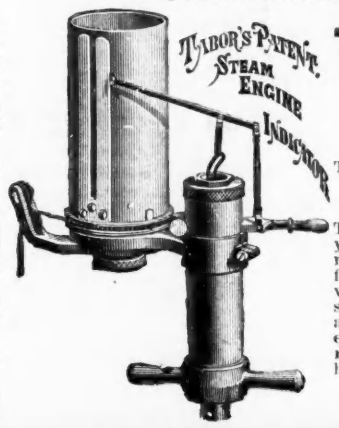
HORIZONTAL BORING MACHINE.
The Star Tool Co.,
MACHINIST TOOLS.
FACTORY:
Providence, R.I.
OFFICES
Boston: 220 Franklin St.
Chicago: 228 Lake St.

CLEVELAND TWIST DRILL COMPANY,
24 & 26 West St., Cleveland, O.
101 Chambers St., New York
Mail B'ld'g Toronto, Canada.

BETTS MACHINE COMPANY,
Wilmington, Del.
MAKERS OF
IMPROVED
MACHINE TOOLS
—FOR USE IN—
Railway & Machine Shops,
From Patterns of the most
MODERN CONSTRUCTION.

NICHOLSON FILE CO.,
SOLE MANUFACTURERS OF
FILES AND RASPS
HAVING THE INCREMENT CUT.
Also, FILERS' TOOLS AND SPECIALTIES.
"Nicholson File Co's" Files and Rasps, "Double Ender" Saw Files, "Slim" Saw Files, "Racer" Horse Rasps, Handled Rifflers, Machinists' Scrapers, File Brushes, File Cards, Surface File Holders, Vise File Holders, Stub Files and Holders, Improved Butchers' Steel.
Manufactory and Offices at **PROVIDENCE, R. I. U. S. A.**

TESTIMONIAL ON THE MERITS OF THE
TABOR INDICATOR.



ARMINGTON & SIMS ENGINE CO.,
PROVIDENCE, R. I., August 24th, 1883.
THE ASHCROFT MFG. CO.,
111 Liberty Street, New York.

Gentlemen:—Your letter received. Our experience with the Tabor Indicator has been satisfactory. We ordered one of your first indicators to test our 12x12 engine, running 350 revolutions per minute. This was the first engine we built for Mr. Edison, it was sent to the Paris Electrical Exhibition with his large dynamo; we have built 135 engines for him since, we used every indicator in the market at that time, and all failed to produce a satisfactory card at 350 revolutions, except the Tabor. **To this instrument is our success in a measure due.** We now have three Tabor indicators and you have our order for one pair to be sent to England.

Respectfully yours,
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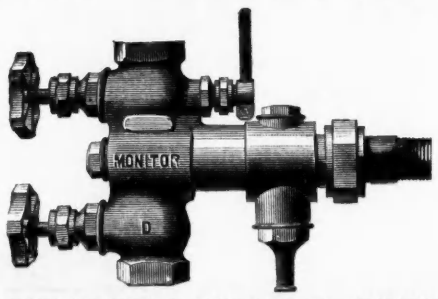

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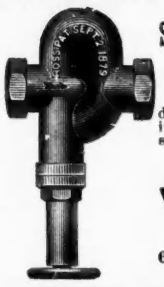

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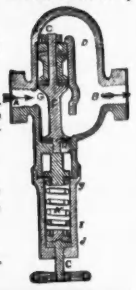

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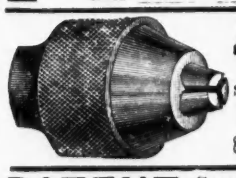

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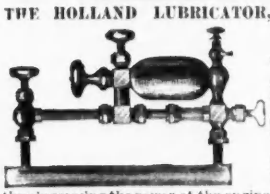

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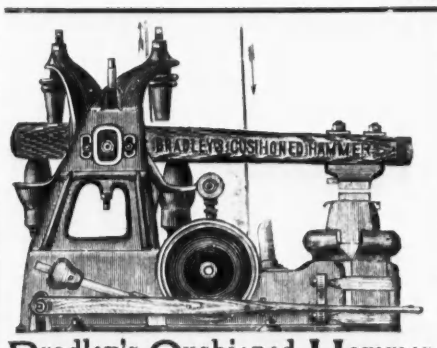

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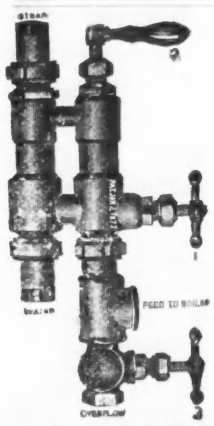

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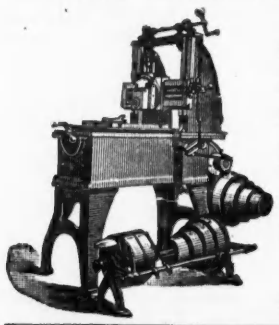

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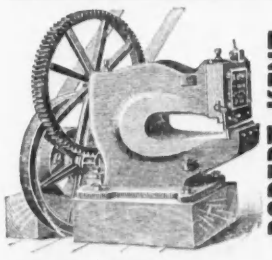

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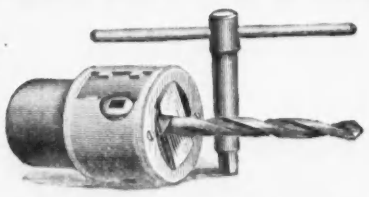

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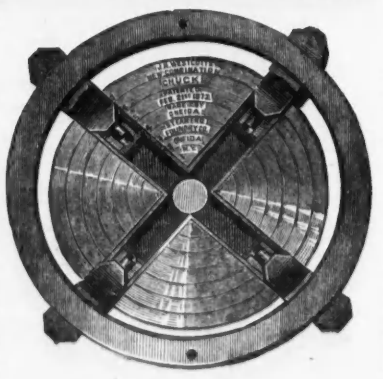

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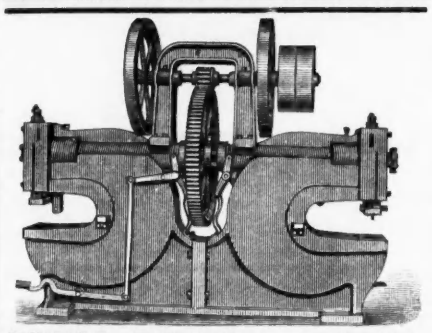

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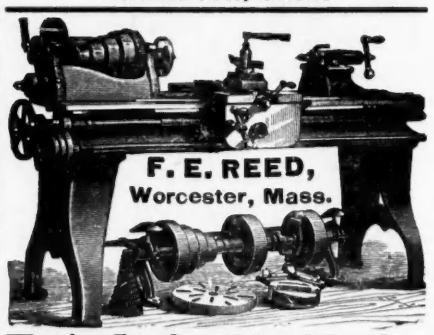

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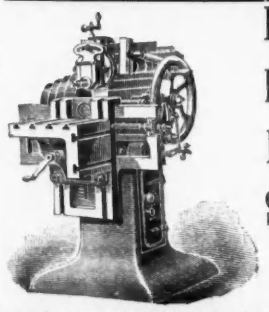

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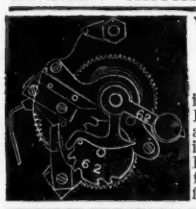

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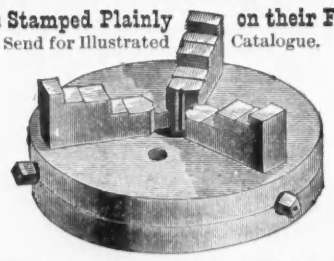

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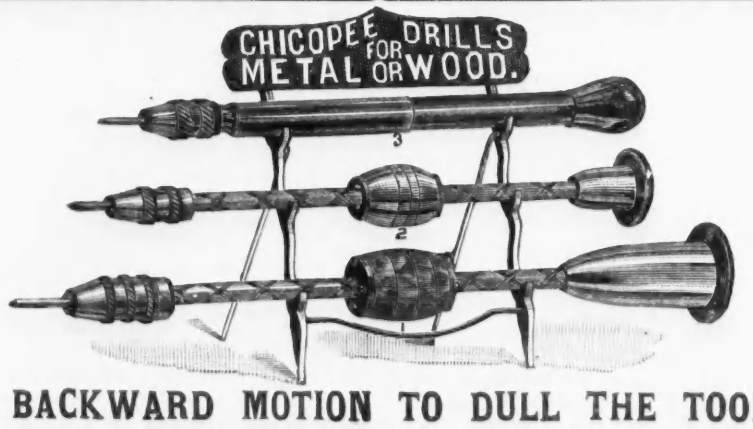

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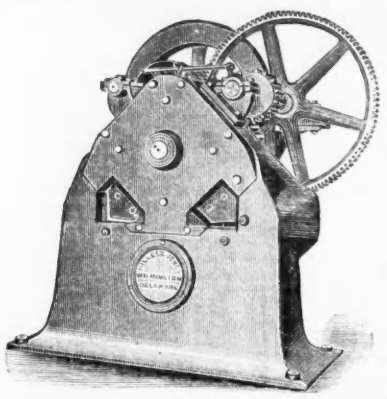

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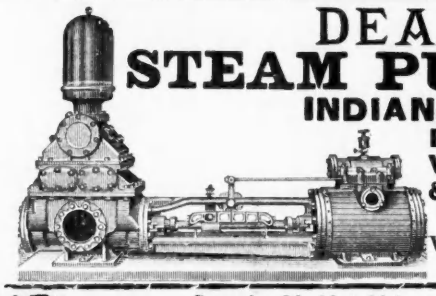

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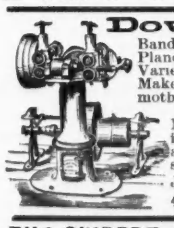

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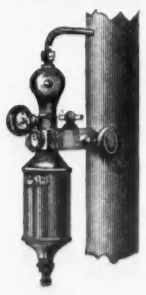

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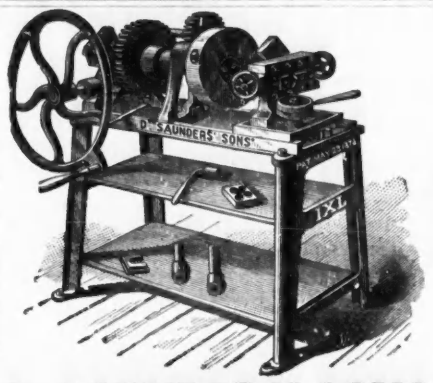

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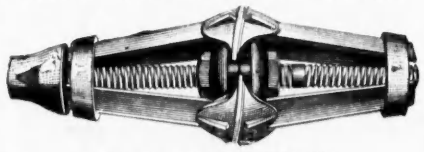

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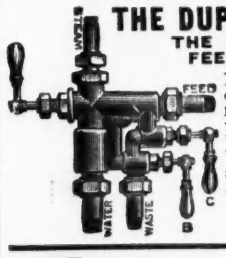

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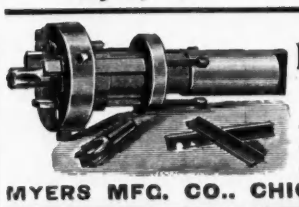

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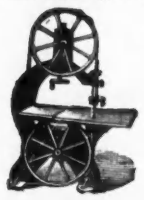

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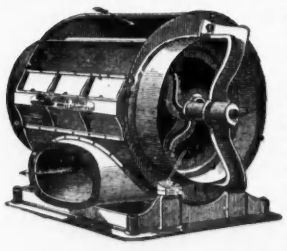

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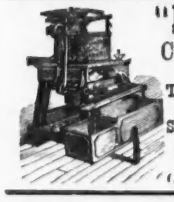

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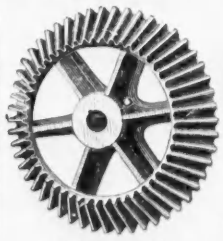

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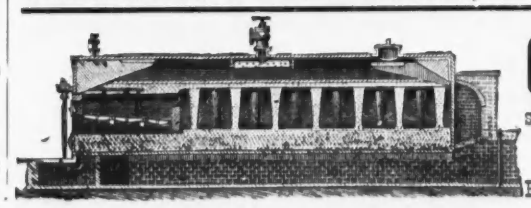

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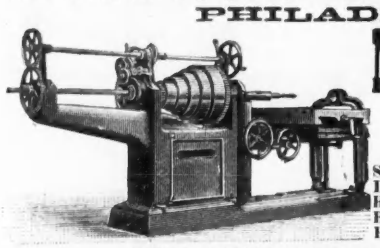

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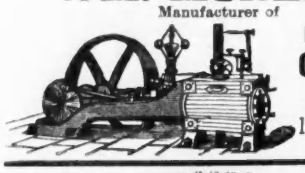

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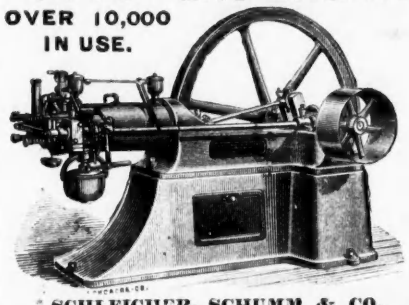

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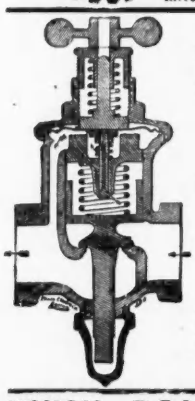

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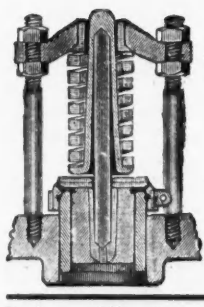

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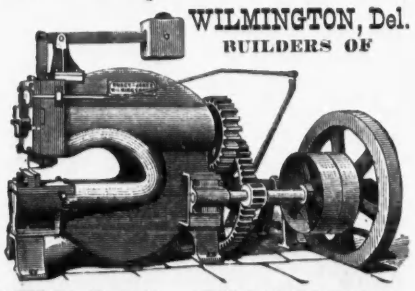

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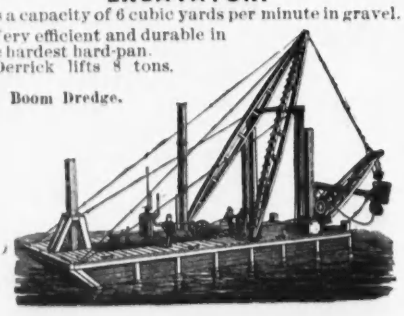

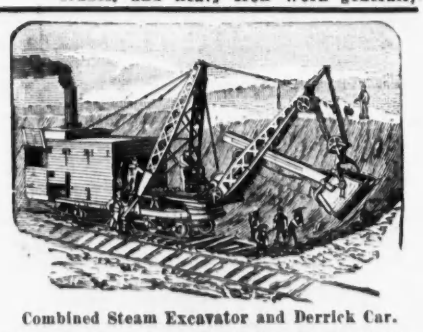

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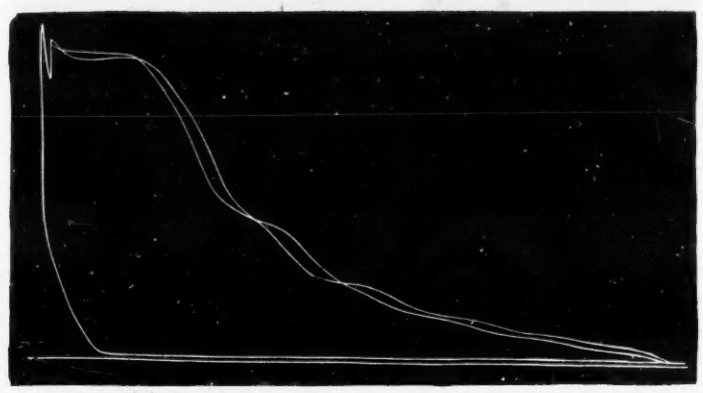

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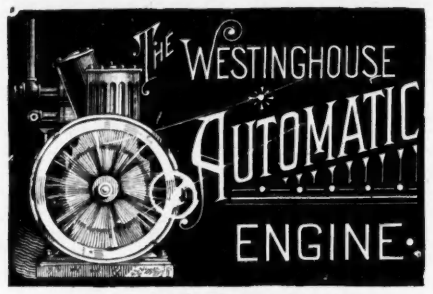

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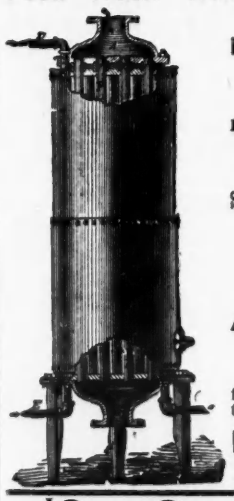

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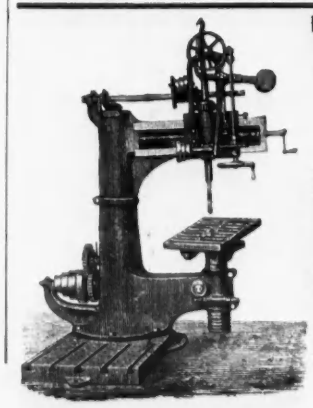

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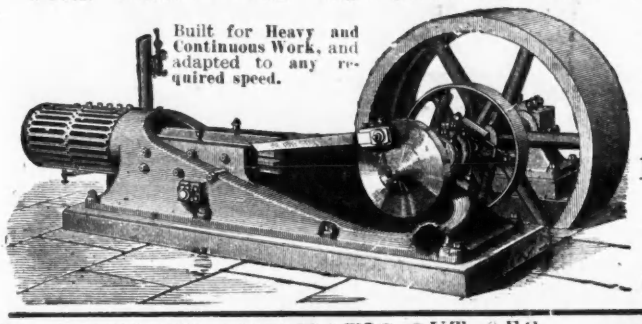

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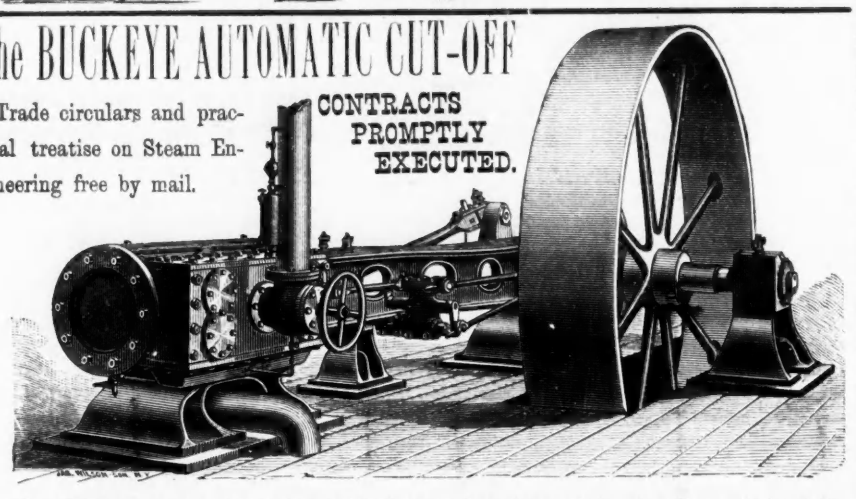

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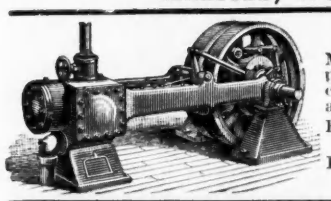

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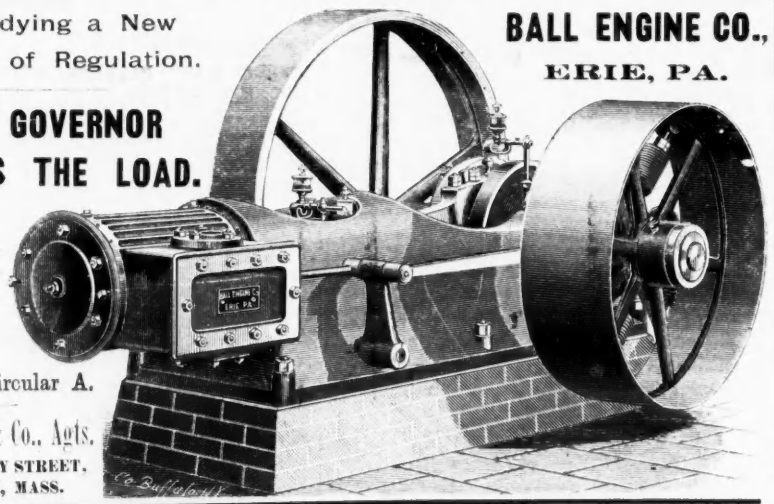

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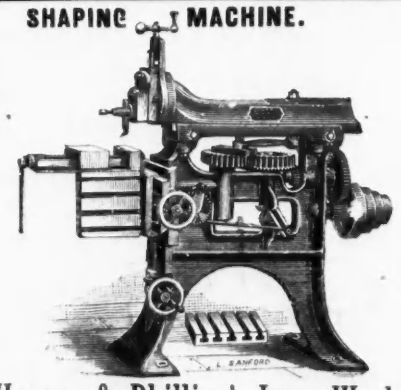

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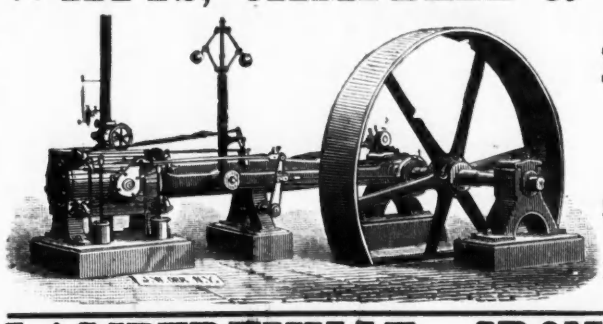

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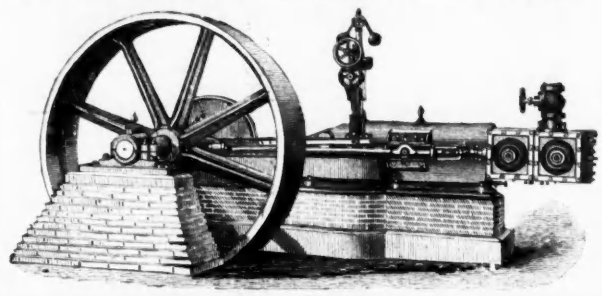

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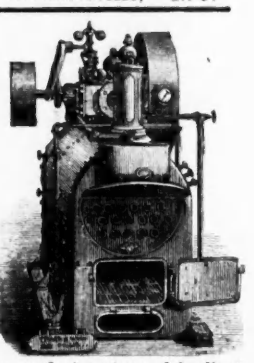

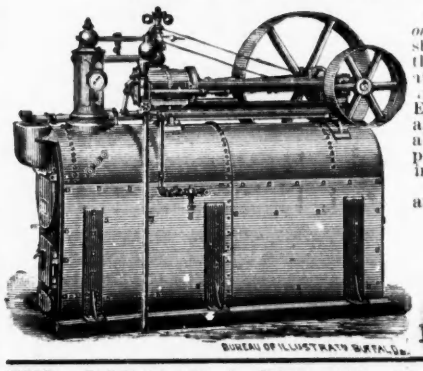

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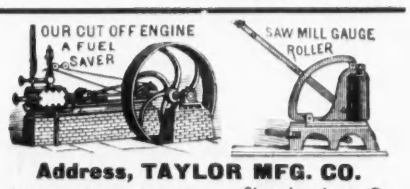

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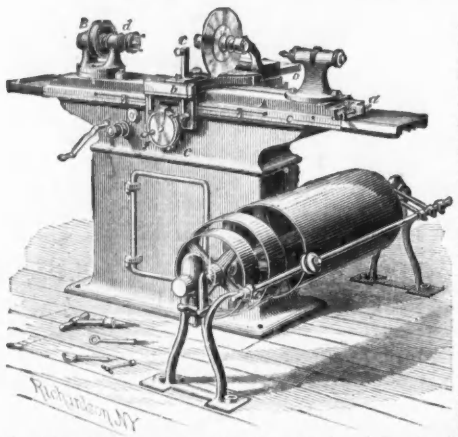

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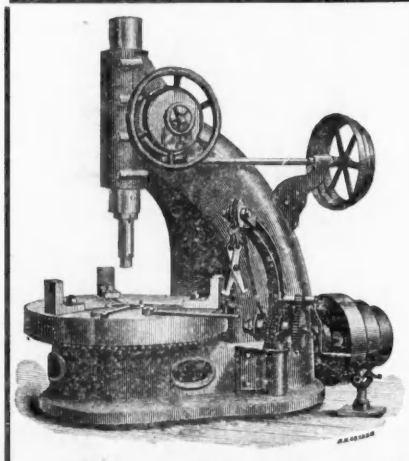

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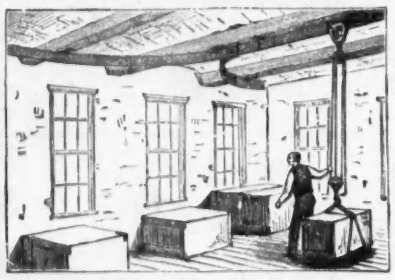

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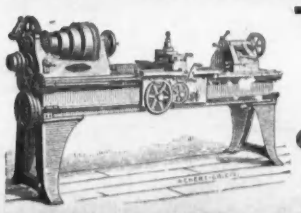

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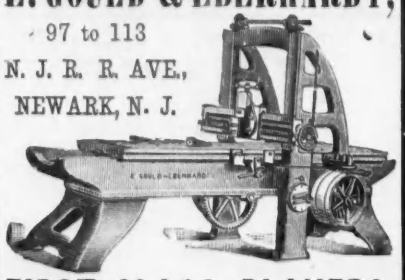

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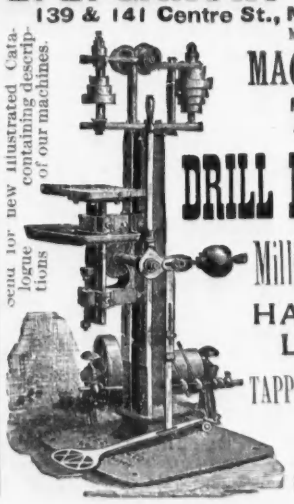

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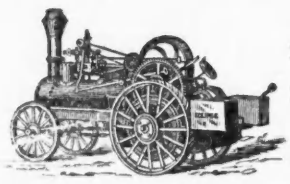

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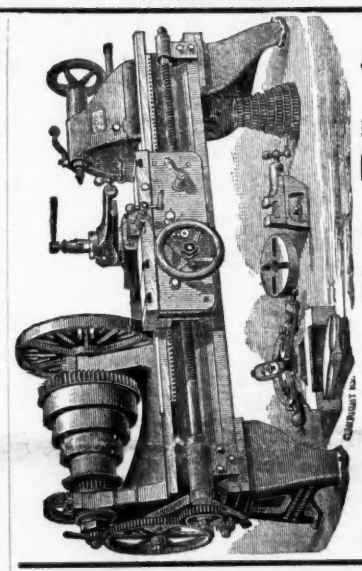

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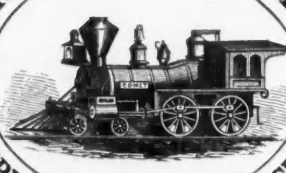

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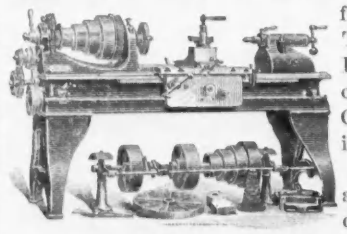

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